DOCUMENT RESUME

ED 384 821 CE 069 562

TITLE	The Illinois Plan for Home Economics Education. A Curriculum Guide. Living Science Course.
INSTITUTION	Illinois State Univ., Normal. Dept. of Home Economics.
SPONS AGENCY	Illinois State Board of Education, Springfield. Dept. of Adult, Vocational and Technical Education.
PUB DATE	Sep 92
NOTE	220p.; For related documents, see CE 069 560-564.
AVAILABLE FROM	Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC09 Plus Postage.
DESCRIPTORS	*Career Exploration; Course Content; Course Descriptions; Employment Opportunities; *Experiments; *Home Economics; Learning Activities; Lesson Plans; Problem Solving; *Science Activities; *Science and Society; Secondary Education; State Curriculum Guides; Teaching Methods; Technological Advancement; Thinking Skills
IDENTIFIERS	Illinois

ABSTRACT

The rapid growth of science and technology has a tremendous impact upon how an individual functions in today's society. This experiment-oriented course encourages the student to investigate home economics subject matter from a scientific viewpoint. Using the scientific method to solve problems and make decisions, the student conducts laboratory experiments to examine the chemical composition of food, to study the physical development of the human body, to analyze construction qualities of textiles and apparel, and to explore methods to conserve the earth's resources. Emphasis is placed on developing an understanding of how biology, chemistry, technology, and the environment affect life. Included is an awarenes of personal and ethnical responsibility. A variety of careers are explored dealing with these science-oriented home economics areas. The guide contains the following materials: a course description, course objectives, background information for instructors, an abbreviated course outline, a detailed content outline, a bibliography listing 36 references for teachers and students, and a variety of teaching activities. The course outline identifies the major topics, and the more detailed content outline serves as a basis for creating the curriculum, developing lesson plans, and interpreting through the learning activities. The teaching activities develop specific portions of the content outline. Each activity includes the following sections: a teacher's page with student objectives, materials needed, directions, evaluation, Future Homemakers of America-Home Economics Related Organization correlation, teacher notes, and the Illinois State Goals for Learning that are incorporated. Supportive materials such as worksheets and transparency masters are included for some of the activities. (KC)

ED 384 821

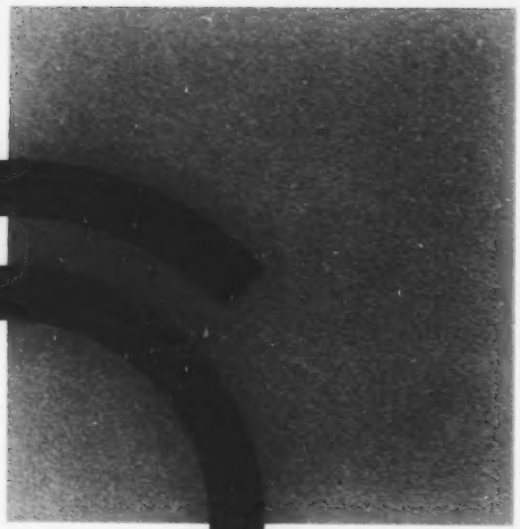
The Illinois Plan For Home Economics Education

A Curriculum Guide

Living Science Course

Illinois State Board of Education

Adult, Vocational and Technical Education



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For Home Economics
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Exploration/Orientation
Curriculum Guide

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September, 1992

This publication was prepared pursuant to a grant from the Illinois State Board of Education, Department of Adult, Vocational and Technical Education, with 100 percent funding through the Carl D. Perkins Vocational and Applied Technology Education Act of 1990, Title IIIB.

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This publication is available from:

CURRICULUM PUBLICATIONS CLEARINGHOUSE
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Macomb, IL 61455

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INTRODUCTION

Thinking creatively, making decisions, relating to and communicating with others, and utilizing scientific technology are necessary for individuals and workers in an ever changing global society. Home economics knowledge and skills are needed today and into the twenty-first century to balance lifestyle with employment.

Included in this curriculum guide are sections entitled "Dimensions for Living"; "Creative Lifeskills"; and "Living Science." These exploration/orientation courses are developed around three themes: enhancing an individual's self-concept and interpersonal relationships, encouraging and developing a creative individual, and discovering and interpreting an individual's scientific and technological world.

All materials incorporate a variety of learning processes, wellness concepts, orientation tasks, and the Illinois State Goals for Learning. Appendices provide supportive materials.

Teaching activities encourage the integration of cooperative learning, higher-order thinking skills, and leadership development through Future Homemakers of America–Home Economics Related Occupations (FHA–HERO).

The development of the guide was made possible through a grant from the Illinois State Board of Education, Department of Adult, Vocational, and Technical Education, Vocational Education Program Improvement Section.

CURRICULUM GUIDE INTERPRETATION

The curriculum guide includes a course description, course objectives, background information for instructors, an abbreviated course outline, a detailed content outline, a bibliography, and a variety of teaching activities. The "Course Description" and "Course Objectives" are helpful in communicating the course's composition to administrators, school board members, guidance counselors, teachers, parents, and students. The "Background Information for Instructors" provides a quick overview of the knowledge, learning process, and skills emphasized in the course.

The "Course Outline," complete with page numbers for locating topics identifies the major topics. The "Content Outline" is detailed and designed to serve as a basis for creating the curriculum, developing lesson plans, and interpreting through the learning activities. Throughout the content outline, a check-mark (✓) in the left-hand column of the page indicates an activity is included for that portion of the outline. "Illinois State Goals for Learning" and sample learning objectives, as addressed by the content outline, are identified by a series of letters and numbers in the right-hand column of the content outline page. The letter and number codes are interpreted as follows:

Subjects:

BPS	=	Biological and Physical Sciences
FA	=	Fine Arts
LA	=	Language Arts
M	=	Mathematics
PDH	=	Physical Development and Health
SS	=	Social Sciences

Example: BPS1-8-E2

Interpretation:

BPS	=	Subject
1	=	State goal number
8	=	Grade level
E2	=	Sample learning objective

The "Illinois State Goals for Learning," which includes sample learning objectives, are included in the "Appendices."

A "Bibliography" follows the content outline. Entries are identified as either student or teacher according to whether the materials were used to develop the student activity pages or the teacher outline.

A variety of teaching activities is included and identified in the "Activities" section. Each activity develops a specific portion of the content outline. A code in the upper right-hand corner of the page identifies the course title, topic, and outline reference which the activity addresses. Every activity includes a teacher's page with student objectives, materials needed, directions, evaluation, FHA–HERO correlation, teacher notes, and the state goals which are incorporated. Supportive materials such as worksheets and transparency masters are included for some of the activities. Teachers are expected to develop additional activities when necessary to teach the courses.

LIVING SCIENCE

COURSE DESCRIPTION

This experiment-oriented course allows the student to investigate a cross section of home economics in the areas of nutrition and food, textiles and apparel, human development, living environments, and management. Emphasis is on laboratory experiments that develop understanding of how biology, chemistry, technology, and ecology affect life. A variety of careers are explored dealing with these science-oriented home economics fields.

COURSE OBJECTIVES

The objectives of the course are as follows:

- to apply scientific principles to everyday life.
- to examine the impact of science and technology upon the development, production, and distribution of products for the individual, home, environment, and workplace.
- to develop an awareness of the individual's responsibility to utilize science and technology for the benefit of the home, community, nation, and world.
- to identify the relationship between the scientific method and other fundamental processes as a means to think about, plan, organize, investigate, and analyze problems.
- to examine available jobs and careers using home economics subject matter and skills and the scientific-oriented application of these.
- to correlate home economics knowledge and skills with the state goals for learning in the areas of biological and physical sciences, fine arts, language arts, mathematics, physical development and health, and social studies.

BACKGROUND INFORMATION FOR INSTRUCTORS

Overview:

The rapid growth of science and technology has a tremendous impact upon how an individual functions in today's society. Microwaves cook food, computers store information, robots perform tasks, and electronics provide entertainment. Being in control rather than being controlled by technology becomes increasingly important. This experiment-oriented course encourages the student to investigate home economics subject matter from a scientific viewpoint. Using the scientific method to solve problems and make decisions, the student conducts laboratory experiments to examine the chemical composition of food, to study the physical development of the human body, to analyze construction qualities of textiles and apparel, and to explore methods to conserve the earth's resources. Emphasis is placed on developing an understanding of how biology, chemistry, technology, and the environment affect life. Included is an awareness of personal and ethical responsibility. A variety of careers are explored dealing with these science-oriented home economics areas.

Emphasis:

I. EMPHASIZING THE SCIENTIFIC METHOD FOR INVESTIGATING PROBLEMS

- A. Making Observations
- B. Forming Hypothesis
- C. Testing Hypothesis
- D. Drawing Conclusions
- E. Evaluating Results

II. RECOGNIZING SKILLS DEVELOPED THROUGHOUT THE COURSE

- A. Identifying Where To Locate and How To Use Information
- B. Reading and Following Directions
- C. Demonstrating Responsibility for Carrying Out Activities and Projects
- D. Organizing and Managing Human and Material Resources
- E. Relating to and Communicating with Others

III. PROVIDING EQUIPMENT FOR THE COURSE

A. Determine Equipment and Supply List for One Lab Station

1. two Pyrex beakers (100 mL)
2. four Pyrex beakers (250 mL)
3. four Pyrex beakers (400 mL)
4. two Pyrex beakers (1000 mL)
5. two sets of plastic beakers
6. four Erlenmeyer flasks (250 mL)
7. two Pyrex graduated cylinders (10 mL)
8. two Pyrex graduated cylinders (100 mL)
9. two Celsius thermometers (-20° to 110°C)
10. six Pyrex test tubes (18mm x 150mm)
11. two test tube brushes
12. test tube rack
13. two metal diffusers (for electric stoves)
14. two ring stands with utility clamps
15. two one-hole stoppers
16. six stoppers (#2)
17. one triple beam balance

B. Pursue Possibility of Acquiring Expensive and Seldom Used Equipment from the Science Department or Through Donations from Local Businesses

1. triple beam balances now being replaced with digital electronic balances
2. standard laboratory equipment

C. Explore Borrowing Expensive and Seldom Used Equipment

1. glass burets
2. microscopes

LIVING SCIENCE COURSE OUTLINE

		PAGE
I.	**EXAMINING HOW SCIENCE AND TECHNOLOGY IMPACT LIFE**	S-5
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LIVING SCIENCE CONTENT OUTLINE

ACTIVITY		STATE GOALS
	I. EXAMINING HOW SCIENCE AND TECHNOLOGY IMPACT LIFE	BPS2-10-A1 BPS2-12-E1 SS4-8-J2
✓	A. Recognizing Innovations Affecting the Individual, Family, and Worker.....	BPS2-8, 10-C3
	1. Identify food advances	
	a. reduced food spoilage through refrigeration, processing, packaging, and transportation	
	b. altered nutritional value through molecular changes	
	1) cheese and meat products with reduced fat content	
	2) egg substitutes to reduce cholesterol intake	
	c. increased consumer convenience	
	1) microwave cooking to save time and energy	
	2) all-in-one packaging used to prepare and serve product	
	2. Acknowledge textile and apparel changes	
	a. produce synthetic fabrics from petroleum products	
	b. use computers to design, lay out, cut, and construct garments	
	c. increase safety and convenience through fabric finishes	
	1) water-repellent	
	2) wrinkle-resistant	
	3) flame-retardant	
	3. Appreciate technological improvements associated with human development....	BPS2-10-D4
	a. detect, prevent, and control disease	BPS2-10-F2
	1) diagnostic equipment	
	2) immunization	
	3) surgical procedures	
	4) medical research	
	b. provide family planning methods	
	c. apply nutrition research to food selection and preparation	
	d. utilize equipment to promote physical fitness	
	e. develop methods to counter sexually transmitted diseases	

4. Focus on technological variations related to management
   a. promote interpersonal relationships
      1) telecommunication
      2) audio/video equipment
   b. control information and products
      1) computers
      2) fax machines
      3) robots
      4) calculators
5. Increase livability and comfort within the home and workplace through technology BPS2-8-C3
   a. accelerate construction by mass production
   b. offer alternative heating systems with solar, electrical, and gas energy
   c. provide more options with new construction materials and techniques
   d. offer flexibility through computer-aided design
   e. create new fibers and finishes; alter fabric construction techniques
6. Review technological progress in health, fitness, and appearance
   a. provide scientific analysis to substantiate facts versus fallacies regarding products and product claims
   b. formulate safe and enhancing grooming aids for men and women
   c. create skin care products to protect the skin from the environment
   d. develop vitamin and food supplements to compensate for diet or body deficiencies
   e. acknowledge hair treatments and preparations such as dyes, straighteners, and conditioners
   f. recognize the growing fragrance industry
   g. realize the availability of cosmetic and reconstructive surgical techniques

✓ B. Dealing with Individual Responsibility in a Scientific and Technological Society BPS2-12-H2 SS4-8, 10-H1

1. Show concern for the environment BPS1-12-E2
   a. control pollution SS4-8-14
      1) air SS4-10-11
      2) water
      3) space
   b. address the disruption of earth and air

1) landfills
2) ozone layer
3) greenhouse effect

c. conserve resources
1) proper use of equipment and products
2) time and energy management
3) recycle products

d. plan for future generations SS2-8-B2
1) food supply
2) population control
3) land utilization

2. Address ethical decisions BPS2-12-A2

a. deal with medical dilemmas BPS2-12-C1
1) genetic engineering
2) euthanasia
3) organ transplants

b. focus on electronic communication
1) computer security
2) media distortion
3) privacy invasion

c. deal with conflicts to an individual's values SS5-8-K3
1) over-extension of physical and emotional capabilities
2) family obligations and expectations
3) workplace demands
4) replacement of human power by machine power
5) job transfers or mobility
6) self-centeredness and over-aggressiveness

C. Utilizing the Scientific Method as a Basis for Exploring Home Economics

1. Recognize the need to observe, organize, test, and evaluate data BPS3-8-B3

✓ a. identify steps of the scientific method BPS4-8-G1

✓ 1) make observations
2) form hypothesis
3) test hypothesis
4) draw conclusions
5) evaluate results

b. correlate with decision-making process SS5-8-A1

1) define problem
2) gather information
3) weigh alternatives
4) make decision
5) evaluate decision

✓✓ 2. Realize the transferability of the processes to a variety of problems and situations

3. Establish laboratory procedures to incorporate the scientific method BPS3-8-B6

✓ a. focus on safety measures

1) wash hands prior to all laboratory work
2) wear aprons and safety goggles as needed
3) restrain long, loose hair
4) read and understand directions before beginning laboratory work
5) keep fingers out of mouth
6) cut on an appropriate surface
7) use a metal trivet or insulating pad when heating beakers
8) remember hot glass looks like cold glass
9) turn off heating elements when finished
10) never heat an empty beaker; remove before contents boils away
11) clean up all broken glass and report breakage

✓ b. develop method of reporting experimental results

1) adopt systematic format
2) organize laboratory reports in a notebook
3) follow step-by-step procedures to conduct the experiment
4) record observations and findings in data table
5) draw conclusion about the experiment

✓ c. become familiar with laboratory equipment BPS4-8-A1

1) beakers
2) Erlenmeyer flasks

✓ 3) graduated cylinders

4) Celsius thermometers
5) test tubes
6) ring stands with utility clamps
7) stoppers

✓ 8) triple beam balance

9) microscope
10) meter stick

II. INTERRELATING LABORATORY EXPERIMENTS WITH HOME ECONOMICS CONTENT FOR PERSONAL USE AND WORK APPLICATION

A. Introducing Basic Scientific Terms

1. Define and classify matter BPS1-12-C1
   a. has mass and occupies space
   b. divided into two categories
      1) pure substances: made up of only one kind of material with definite and constant properties
      2) mixtures: composed of two or more substances in varying amounts
2. Compare and contrast elements and compounds BPS1-10-F5
   a. identify elements as simplest type of pure substances
      1) cannot be broken down by ordinary chemical means
      2) used to form all other materials
      3) find more than one hundred elements in nature
      4) referred to as metals or nonmetals
      5) include oxygen (O), carbon (C), hydrogen (H)
   b. recognize compounds as two or more elements which are chemically attached
      1) results in a substance with completely different properties
      2) can be broken down into original elements
      3) referred to as organic or inorganic compounds
      4) examples include table salt (NaCl), water (H_2O), and sugar ($C_6 H_{12} O_6$)
3. Describe heterogeneous and homogeneous mixtures
   a. recognize heterogeneous mixtures by sight
      1) are not uniform in makeup or properties
      2) often unevenly distributed in the mixture
      3) examples include tossed salad, submarine sandwich, and pizza
   b. explain homogeneous mixtures as being the same throughout every part of the sample
      1) cannot be recognized by sight
      2) often called solutions when one substance is dissolved in another
      3) examples include iced tea, salt water, and air
4. Record chemical information using symbols, formulas, and equations
   a. represent elements by abbreviations called symbols
      1) contains one, two, or three letters, capitalizing first letter
      2) stands for one atom of the element
      3) arranged vertically on a periodic table according to element's properties

✓ b. combine chemical symbols to form chemical formulas

1) represents a molecule of a compound or an element: HCl

2) shows the elements and ratio of elements in a compound: H_2O

3) uses subscripts after element's symbol to show ratio of atoms: O_2

✓ c. write description of a chemical reaction by use of equations

1) includes symbols and formulas

2) describes the process of changing properties of substances into new substances with different properties

3) appears as an algebraic equation

4) begins with reactants; ends with products

5. Identify the properties of an atom BPS1-8-C1

a. defined as smallest part of an element that keeps the chemical properties of the element

b. made up of subatomic particles

1) protons: positively charged particles located in nucleus or center of the atom

2) neutrons: uncharged particles found in the nucleus

3) electrons: negatively charged particles moving around outside the nucleus

c. considered neutral when negatively charged electrons equal positively charged protons

d. reacts with other atoms via electron interaction

6. Recognize the role of chemical bonding BPS1-8-D2

a. identified as the force holding atoms together in the molecule

b. form bonds depending on number and type of electrons present in the atom of the element

c. creates an ionic bond when an electron is transferred from one atom to another

1) form attraction between opposite electrical charges

2) refer to charged particles as ions

3) form positive (+) ions from metals

4) create negative (-) ions from nonmetals

5) produce ionic crystals when metals and nonmetals bond: NaCl, sodium chloride (table salt)

d. produces a covalent bond when atoms share electrons with each other

1) enable nonmetals to bond

2) become stable by having a positive (+) and negative (-) end

3) recognize water (H_2O) as an example

✓ 7. Differentiate between physical and chemical changes

a. distinguish a physical change as a change in size, shape, or physical state, but not identity of the substance

1) does not change basic chemical nature of matter

2) occurs when a mixture is formed

3) may involve phase changes where matter changes from one state to another: solid, liquid, or gas

b. define a chemical change as a process where substances become new and different substances

1) able to write equation to describe reaction

2) may be reversible: human-plant cycle with glucose, oxygen, carbon dioxide, water

3) can be irreversible: burning, fermenting, digesting

8. Correlate scientific concepts with home economics-related subject matter

a. identify foods, textiles, housing materials according to the classifications of matter

✓ b. recognize names and symbols of the elements most often used in food and textile science

c. distinguish salts or crystals resulting from ionic bonding

1) NaCl–sodium chloride (table salt)

2) $NaHCO_3$–sodium bicarbonate (baking soda)

3) $KHC_4H_4O_6$–potassium bitartrate (cream of tartar)

d. differentiate between physical and chemical changes in food BPS1-10-D1

1) cooking is a chemical change

2) slicing, chopping, or peeling is a physical change

3) combination of physical and chemical changes necessary for digestion to occur

4) may or may not have effect on nutritional value of the food

B. Analyzing Products Through Sensory Evaluation

1. Identify the human sense organs

a. eyes

b. nose

c. tongue

d. skin

e. ears

2. Recognize need for human senses

a. aids in survival
b. enhances enjoyment of products
c. detects stimuli
d. stimulates needs and wants

3. Define sensory evaluation
✓ a. test products scientifically using the human senses ..... BPS- 1O-F1
b. acknowledge the interdependence of the senses
c. judge by comparing to set standards

4. Distinguish the sensory characteristics of food BPS1-8-P3
a. perceive the effect of color and texture upon appearance
1) preconceived ideas form expectations of the product
2) color may indicate quality or be used for decorative purposes
3) variety of textures stimulates the appetite
4) different sizes and shapes create a pleasing appearance
b. interpret odor as an appetite stimulator or safety mechanism
1) aromas produce memories
2) spoiled food has distinctive odor
c. distinguish flavor
✓ 1) taste buds sense bitter, sweet, salty, or sour flavors
2) taste blindness causes inability to distinguish among flavors
3) volatile substances in food are intensified by temperature
4) chemical enhancers such as monosodium glutamate increase intensity of flavors
d. describe how food feels in the mouth (mouthfeel)
1) lips and tongue determine
2) texture and tenderness can be distinguished
3) temperature has an effect
e. react to sound
1) opinion of product is formed or changed
2) product gains or loses appeal as a result

5. Generalize information to other consumer products
a. judge according to appearance
1) apparel and image of worker influence first impression
2) color and texture of materials add to appeal
3) size and shape of product trigger identification
b. react to odor

1) disinfectants
2) fragrances
3) fabric finishes

c. respond by touching
1) quality of production may be determined: smooth versus rough wood finish
2) durability is perceived by feel: denim, satin
3) person-to-person interaction conveys acceptance or rejection

d. distinguish through hearing
1) recognition by noise of product: cereal, video games
2) emotion expressed through tone of voice

C. Discovering Why and How the Body Utilizes Food BPS1-10-K1

1. Recognize the necessity of food conversion to release nutrients needed by the body BPS1-12-N3

a. review nutrients provided by food PDH2-8-F3
1) proteins
2) carbohydrates
3) fats
4) vitamins
5) minerals
6) water

b. acknowledge functions provided by nutrients BPS1-8-N1
1) build, repair, and maintain body tissues
2) regulate body processes
3) provide energy

✓✓ 2. Trace how food is turned into usable nutrients by digestion

a. enters body through the mouth
1) teeth grind, tear, and mash into smaller pieces
2) saliva moistens food
3) ptyalin enzyme begins carbohydrate (starch) breakdown
4) tongue pushes food around and back to the throat
5) digestion time is approximately two minutes in mouth

b. moves into the esophagus
1) a 10" (25 cm) tube connecting the mouth to the stomach
2) rhythmic muscle movement (peristalsis) pushes food along to the stomach

3) food passes through in less than one minute

c. churns in the stomach

1) muscle contraction and relaxation mixes food with gastric juices secreted from stomach glands

2) gastric juices composed of concentrated hydrochloric acid and the pepsin enzyme begin protein breakdown

3) food remains in stomach about 240 minutes (4 hours) with carbohydrates remaining the least amount of time and fats the longest amount of time

4) stomach holds about 1 1/2 quarts (1.4 liters) of liquid and food

5) stomach enlarges after eating; collapses to size of large sausage when food leaves

6) contractions force digested food (a thin paste) into the small intestine

d. completes digestion in small intestine

1) a coiled tube about 1/2" to 1 1/2" (1 1/4 to 3 3/4 cm) in diameter and 20' (7 meters) long fills abdomen

2) walls move in and out to move undigested food along intestine

3) digestive juices from the intestine, pancreas, and bile break down food

4) intestinal juices within wall lining contain enzymes to digest carbohydrates and proteins

5) pancreatic juice formed in the pancreas contains three different enzymes to digest fat, protein, and carbohydrate

6) sodium bicarbonate released by pancreas reduces acidity of the food

7) bile produced in the liver and stored in the gallbladder enters the small intestine and breaks up large fat droplets

8) food takes about 720 minutes (12 hours) to move through small intestine

9) nutrients produced are amino acids from protein, glucose from carbohydrates, and fatty acids and glycerol from fats

3. Release nutrients from the small intestine by absorption

a. passes through the villi of the small intestine

1) villi appear as small, hairlike projections on the lining

2) increased surface area allows greater absorption

3) amino acids, glucose, minerals, and some vitamins are carried to the blood stream

4) fatty acids, glycerides, and some vitamins pass into the lymphatic system

5) sugars, amino acids, and fatty acids are transported to the liver

b. continues nutrient changes in the liver

1) glucose or blood sugar is formed from certain sugars and digested fats

2) unused glucose is stored as glycogen which is reconverted to glucose when blood-sugar level becomes low

3) excess glucose is stored as body fat

4) portion of digested fats is converted into immediate energy

5) some amino acids are produced and stored briefly; remainder are converted and stored as body fat

4. Prepare undigested food for waste removal

a. moves from small intestine into the large intestine

1) rippling movement of the walls moves foodstuff through tube

2) large intestine is larger in diameter (2" to 3") and shorter in length (5' to 6') than small intestine

3) function is to remove water from any undigested food

4) some remaining minerals and water are absorbed into the bloodstream

5) food remains in large intestine about 240 minutes (4 hours)

b. transported to kidney and rectum for elimination

1) excess water is moved to kidney and excreted

2) dietary fiber (roughage) of undigested food waits in rectum and passes out through anus at regular intervals

3) food moves through entire digestive system in about twenty to twenty-four hours

5. Deliver nutrients throughout the body by circulation

a. depends on heart to pump blood through blood vessels to all parts of the body

1) arteries carry nutrients and oxygen

2) veins remove waste

b. uses blood plasma to carry nutrients absorbed from small intestine and oxygen from the lungs to the cells

c. absorbs nutrients and oxygen from the capillaries into the cells

d. diffuses carbon dioxide and waste fluids from cells back into blood stream

e. utilizes blood to transport waste fluids to the kidneys for excretion and carbon dioxide to the lungs to be exhaled

f. repeats the rhythmic heart pumping over and over

6. Produce and release energy for the body through the metabolic process

a. utilizes three nutrients broken down by digestion and absorption to produce energy
   1) break down carbohydrates to glucose to provide energy for the brain and nervous system
   2) convert fats to fatty acids to supply energy for muscles and to serve as a reserve storehouse of energy
   3) resort to protein's amino acids for energy when carbohydrate and fat supplies are unavailable

b. regulates body's autonomic processes
   1) breathing
   2) circulating blood
   3) regulating body temperature
   4) building and repairing cell tissue

c. controls and performs external physical movements
   1) energetic activities: running, swimming, biking
   2) sedentary activities: sitting, standing, lying down

d. occurs as chemical reactions within body cells

✓ 1) osmosis regulates concentration of body chemicals on either side of a cell membrane
   2) oxidation breaks down glucose and acids to form carbon dioxide, water, and energy
   3) Adenosine diphosphate (uh-DEN-uh-seen die-FOS-fayt) (ADP) molecules combine with energy produced by oxidation to form adenosine triphosphate (uh-DEN-uh-seen tri-FOS-fayt)(ATP) molecules which are carried in the cells and released for energy as needed

✓ 7. Acknowledge the cause and effect of a dysfunctional body PDH2- 12-G1

a. triggered by emotional stress PDH2-12-J1
   1) depression or sadness blocks production of gastric juices causing digestion to stop: "lead stomach"
   2) aggression and resentment increase gastric juice production; and if no food is present to digest, heartburn results
   3) anger speeds up peristalsis, pushing food along before digestion is complete and causing indigestion: stomach "tied in knots"
   4) fear slows down production of saliva causing mouth to feel dry

b. caused by nutrient deficiency
   1) body doesn't have enough time to or is incapable of digesting food

2) body is not supplied with sufficient food containing the nutrients needed by the body

c. results in complications

1) ulcer is caused by stomach lining being eaten away by gastric juices

2) constipation occurs when food moves too slowly through the digestion system

3) diarrhea happens when food moves too rapidly through intestines

4) dehydration often associated with diarrhea and the increased loss of water and decreased nutrient absorption

D. Selecting Nutrients for Wellness

1. Classify foods according to nutrient composition M6-10, 12-E1

a. identify by chemical analysis M6-12-G1

b. determine through reference materials

1) National Dairy Council comparison cards and foods models

2) USDA Composition of Foods tables

c. interpret the daily food guide PDH2-8-F2

1) milk group provides calcium, protein, and riboflavin

2) meat group provides protein, niacin, thiamine, and iron

3) fruit and vegetable group provides vitamins A and C

4) grain group provides carbohydrates, thiamine, niacin, and iron

5) "others" category provides fats and carbohydrates

2. Recognize nutrient requirements throughout the life cycle PDH2-10-F3

a. explain established dietary recommendations

b. acknowledge differences regarding the daily food guide

c. refer to U.S. Department of Agriculture dietary guidelines (*Report of the Dietary Guidelines*, 1990)

3. Distinguish serving sizes and portions

a. measure ingredients

1) liquid

2) dry

b. recognize servings in the milk group

1) 1 cup liquid dairy products

2) 1 cup yogurt

3) 1 ounce cheese

4) 1/2 cup cottage cheese

5) 1/2 cup ice cream, frozen yogurt

c. acknowledge servings in the meat group
   1) 2 to 3 ounces lean meat, fish, poultry
   2) 1 egg
   3) 2 tablespoons peanut butter
   4) 1/2 cup cooked dried peas or beans
   5) 1/4 cup nuts, seeds

d. identify servings in the fruit/vegetable group
   1) 1 piece fresh fruit or vegetable
   2) 1/2 cup cooked or canned fruit or vegetable
   3) 1/2 cup fruit juice
   4) 1/2 grapefruit
   5) 1/4 cantaloupe
   6) 1/4 cup dried fruit

e. determine servings in the grain group
   1) 1 slice bread
   2) 1/2 English muffin, hamburger bun, or bagel
   3) 1 ounce ready-to-eat cereal
   4) 1/2 cup cooked cereal, rice, pasta, or grits
   5) 1 tortilla, roll, or muffin

4. Apply nutrient guidelines to evaluate and plan diet programs PDH2-10-F1
   a. follow the daily food guide plan
      1) include foods from the basic food groups
      2) eat a wide variety of foods
      3) practice moderation
      4) consider nutrient density
   b. modify for special dietary requirements
      1) low cholesterol
      2) diabetic
      3) low sodium
      4) vegetarian
      5) high calcium

5. Acknowledge relationship between diet and personnel/worker productivity PDH1-8-E3
   a. recognize the effect of nutrient deficiency BPS1-10-11
      1) lowered immunity due to lack of protein PDH2-12-G1
      2) fatigue and constipation as a result of carbohydrate shortage
      3) tiredness and listlessness caused by insufficient B vitamins

4) leg cramps and dehydration result from lack of sodium, chlorine, and potassium
5) skin bruising and gum bleeding occur more easily from lack of vitamin C
6) brittle bones and deteriorating tooth formation caused by lack of calcium and phosphorus
7) eye diseases and acne result from inadequate amounts of vitamin A

b. identify benefits of a balanced diet
1) increased energy
2) decreased illness
3) improved attention span
4) decreased absenteeism
5) enhanced personal appearance
6) elevated self-image

E. Dealing with Metabolism BPS1-12-D3

✓ 1. Determine daily energy (calorie) needs BPS2-8-F1

a. calculate basal metabolic rate (BMR)
1) known as speed at which energy is used to sustain internal body processes
2) convert body weight from pounds to kilograms by dividing pounds by 2.2
3) multiply weight in kilograms by 22 for a woman, 24 for a man, to estimate total basal calories needed daily

b. recognize factors affecting BMR
1) age: higher for infants and teenagers due to growth
2) body surface area: higher for larger person due to heat lost through body surface
3) gender: higher for males due to lower percent of body fat and greater proportion of active lean tissue
4) environmental temperature: increased by exposure to cold
5) body temperature: increased by illnesses and fever
6) supply of nutrients: slows down when inadequate nutrients are consumed

c. estimate calories, or energy, expended to perform external physical activities
1) varies from person to person, activity to activity, and changes from day to day

2) determined by pace and length of time spent on an activity
3) consult charts for energy expenditures for typical activities
4) multiply basal calories by activity level: 20% for sedentary, 30% light, 40% moderate, 50% vigorous, or 50% strenuous to yield total calories needed for physical activity

d. compute for specific dynamic effect (SDE)
1) known as energy expended by body to digest and absorb nutrients from food
2) ranges from 6% to 10% of the body's total energy expenditure
3) add basal calories and calories for physical activity to yield calories expended
4) multiply calories expended times 10% to yield total SDE calories

e. combine figures for total energy output
1) add basal calories plus calories for physical activity plus SDE calories
2) sum represents total calories expended

f. acknowledge individual energy needs at various stages in the life cycle
1) refer to charts for daily energy needs based on age, weight, and height
2) consult health professionals

2. Develop a sense of calorie balance for weight control
a. acknowledge basic rule of thumb for loss or gain
1) gain weight by increasing energy intake (food/calorie consumption) beyond energy output (physical activity)
2) lose weight by increasing energy output (physical activity) over energy intake (food/calorie consumption)
3) eat 500 calories more/less per day to gain/lose one pound per week

b. determine energy content of foods
1) refer to charts such as those authored by the U.S. Department of Agriculture
2) calculate by using a bomb calorimeter
3) measure by burning portion of food
4) compute nutrient density

c. recognize importance of exercise
1) changes body composition in positive manner
2) alters metabolism to perform better
3) offers psychological benefits of looking and feeling healthy
4) increases self-esteem

5) supports an individual's determination to persist with weight control effort

d. analyze popular weight loss diets

1) fact versus fallacy claims

2) nutrient content and balance

e. plan diet programs for healthy lifestyle

1) teen pregnancy

2) athletic competition

3. Recognize the consequences of nutritional imbalances PDH2-8-G1 PDH2-8-R1

a. obesity PDH2-8-G2

1) increased risk of developing heart disease, diabetes, cancer, hypertension

2) shortened lifespan

3) decreased quality of life

4) appetite suppressants may cause increase in blood pressure and heart rate, depression, and diarrhea

5) surgery of the small intestine poses risks of diarrhea, malnutrition, and kidney stones

b. anorexia nervosa

1) pronounced skeleton-like appearance due to loss in muscle and fat tissue

2) cessation of menstruation

3) reduced bone mass

4) decreased heart rate and blood pressure

5) abnormal blood levels of sodium, potassium, calcium, glucose, and cholesterol

c. bulimia

1) dehydration

2) heart beat abnormalities

3) colon damage

4) soreness, bleeding, or rupturing of the esophagus

5) dental problems due to contact with stomach acid

6) problems with impulse control

7) anxiety and depression

8) abnormal blood levels of sodium, potassium, and calcium

d. hypoglycemia

1) low blood glucose levels

2) fatigue
3) trembling muscles
4) racing heart beat
5) headache and irritability
6) confusion, amnesia, seizures, unconsciousness

e. diabetes
1) high blood-glucose levels
2) inadequate production or abnormal utilization of insulin
3) weight gain or loss, depending on type of diabetes
4) insatiable appetite
5) low activity levels
6) frequent urination

f. atherosclerosis
1) buildup of cholesterol in walls of arteries
2) reduced blood flow to the heart and lungs
3) increased risk of blood clots
4) chest pains and shortness of breath
5) stroke

g. osteoporosis
1) brittle, porous bones
2) loss of height due to spine compression
3) hump back appearance
4) jaw bone deterioration

F. Examining the Composition of Textiles and Apparel BPS2-8-DI

1. Recognize fibers as the basic unit of fabrics

✓ a. identify sources and names of fibers
1) natural fibers: cotton, wool, linen, and silk
2) manufactured fibers: rayon, acetate, nylon, polyester, acrylic, olefin, spandex

b. realize how fibers are formed
1) natural fiber made by physically changing raw materials from plants and animals
2) manufactured fiber produced by converting raw materials into a liquid and forcing through tiny holes (spinneret)

✓ c. distinguish fiber properties which determine the appearance, performance, and comfort of fabrics

1) length: staple fibers (short strands) or filament fibers (long, continuous strands)
2) strength: ability to resist tearing when subjected to tension
3) luster: ability to reflect light
4) absorbency: ability to absorb moisture and to give moisture up to evaporation
5) elasticity: ability to stretch and recover to original length
6) resilience: ability to return to original shape after being compressed or crushed
7) sensitivity: reactions to heat, chemicals, and environmental conditions
8) drapability: ability to hang and fall into graceful shape and folds
9) affinity for dyes: readiness to absorb and retain dye
10) shrinkage: susceptibility to reduction in size when exposed to water
11) cleanliness and washability: hygienic quality of fiber and special care necessary when laundering or dry cleaning

d. differentiate the advantages and disadvantages of fiber's properties
   1) natural fibers
   2) manufactured fibers

2. Convert fibers into yarns suitable for fabric production
   a. identify the types of yarns
      1) spun yarn: made from staple fibers—often fuzzy and bulky
      2) monofilament yarn: made from a single fiber filament—often high denier (fineness of yarn)
      3) multifilament yarn: made from a group of several fiber filaments—often smooth and shiny
   b. examine yarn construction
      1) single yarn: one strand of twisted fibers
      2) ply yarn: two or more single yarns twisted together—number of yarns determines ply
      3) cord yarn: two or more ply yarns twisted together
      4) combination yarn: two or more yarns of same or different fiber content which are twisted together
      5) blended yarn: two or more fibers put together before being spun and twisted into yarn
   c. determine effect of twist upon performance and appearance
      1) highly twisted yarns generally stronger and more durable than yarns with low twist

2) increased twist may reduce the luster and softness of a yarn
3) excessive twist can cause a decorative effect but reduces yarn's strength

d. recognize the advantages of fibers used for blended yarns
1) combines the best properties of each fiber into the blend
2) adds strength and stability to fabric: nylon
3) offers absorbency and comfort: rayon and cotton
4) improves softness and warmth without adding weight: acrylics
5) provides elasticity: spandex
6) gives beautiful luster: silk
7) adds drapability and texture: acetate
8) contributes easy-care, permanent press qualities, as well as, abrasion resistance: polyester

3. Combine fibers and yarns into fabrics
a. recognize methods of fabric construction
1) weaving: interlacing two sets of yarns placed at right angles to each other
2) knitting: interlocking loops of yarn together
3) felting: holding fibers together through a combination of moisture, heat, chemicals, rubbing, and/or pressure
4) bonding: permanently laminating two layers of fabric together
5) braiding: interlacing three or more yarns to form a regular diagonal pattern down the length of the resulting cord
6) knotting: holding threads together when they cross each other as in laces and nets

b. identify the three basic types of weaves
1) plain: simple, even weave—muslin, broadcloth, percale
2) twill: weave with a diagonal line on face of fabric—denim, herringbone, jean
3) satin: weave with long floats producing a flat, smooth, lustrous surface—satin, sateen, damask

c. distinguish the two types of knits
1) weft: one continuous yarn forms horizontal rows of interlacing loops producing a flat or tubular fabric—double knits, stretch terry, jersey, sweater knits
2) warp: many yarns used to form vertical columns of interlacing loops—tricot

d. be aware of the characteristics of woven and knitted fabrics
   1) woven fabrics tend to ravel or fray along cut edges
   2) plain weaves: strong, reversible, and durable
   3) twill weaves: strong, durable, wrinkle and soil resistant
   4) satin weaves: smooth, slippery, and drapable—less durable than plain and twill weaves
   5) knit fabrics tend to "run" rather than tear
   6) knits: flexible, stretchy, wrinkle resistant, form-fitting, lightweight

4. Enhance fabrics with finishing processes
   a. define a finish as any change made to fibers, yarns, or fabrics to improve their appearance, touch, and/or performance
   b. identify mechanical finishes which affect fabric size and appearance
      1) bleaching: removal of natural coloring to produce white goods or to prepare for dyeing or printing
      2) mercerizing: chemical finish applied to add luster, improve dyeing capability, and increase strength
      3) shrinking: compressing fabric while wet to preset and assure only minimal shrinkage with later use
   c. check on chemical finishes which affect fabric performance
      1) permanent press: resin heat-set onto fabric to retain original shape, resist wrinkling, and retain creases or pleats
      2) stain-resistant: makes fibers less absorbent and prevents stains from penetrating fabric
      3) waterproof: rubber or plastic coating to seal fabric so water cannot pass through
      4) water-repellent: wax, metal, or resin coating which allows fabric to shed water
      5) flame-resistant: prevents fabric from supporting or spreading a flame
      6) antistatic: prevent buildup of static electricity
   d. recognize dyeing and printing as finishes used to improve appearance
      1) add color to fabrics by fiber, yarn, or piece dyeing
      2) decorate surface of fabric with motifs, patterns, or designs by printing

G. Recognizing Heat as a Form of Energy BPS1-8-F4

✓ 1. Acknowledge the properties of heat energy
   a. present in the molecules of all three states of matter
      1) solids have molecules locked together in a set pattern

2) molecules within liquids touch but are randomly scattered throughout the substance

3) gases have molecules which are randomly and widely spread out within the substance

b. produces molecular motion within a substance BPS1-8-D2

1) above absolute zero (-273°C) molecules in all matter are in constant motion BPS1-8-F5

2) heat increases the motion of the molecules and reduces the attraction for each other

3) solid molecules vibrate and rotate but remain in formation

4) liquid molecules move about freely touching one another

5) gas molecules travel in random manner

c. identified as specific heat of a substance

1) known as heat capacity of a substance

2) measurement of the energy required to speed up the molecules

3) energy needed to raise temperature of 1 gram of a substance 1°C

4) unit of measure called calorie for use with foods; British thermal unit (Btu) for fuels

5) products with lower specific heat factor heat more quickly than others

d. measured by temperature

1) rise in temperature increases molecular motion and causes an expansion in size of matter

2) Fahrenheit and Celsius thermometer scales are used to distinguish temperature changes

3) freezing point (32°F, 0°C) and boiling point (212°F, 100°C) identify phase changes

e. converts matter from one form to another BPS1-8-F5

1) increased temperature pushes molecules of a solid against one another until there is room to break away forming a liquid substance BPS1-8-L1

2) further heat application causes molecules to travel at high speeds, collide, and escape changing a liquid to a gaseous state

3) sublimation occurs when a solid passes directly into the gaseous state without going through the liquid state

f. absorbed or released as latent heat

1) defined as heat required to create a phase change without a change in temperature

2) heat is always released by warmer and absorbed by cooler substances
3) latent heat is stored, or absorbed, in molecules when substances melt or boil: heat of fusion or heat of vaporization
4) latent heat is released when these substances freeze or condense: . heat of crystallization or heat of condensation

g. transferred through conduction
1) direct transfer of heat energy between adjacent molecules
2) energy flows from warmer molecules to cooler ones until all molecules are the same temperature
3) continuous supply of heat is necessary to maintain constant temperature

h. travels by convection
1) air or liquid currents caused by expansion of a liquid or gaseous substance
2) heated molecules become less dense and rise
3) cooler, heavier molecules sink
4) process continues until all molecules are the same temperature

i. transmitted by radiation
1) waves of energy of high temperature and velocity
2) rays travel through space until they touch the surface of a substance and are absorbed
3) conduction completes the heat transfer throughout the substance

j. penetrates by electromagnetic (microwave) waves
1) short, high-frequency, invisible waves traveling rapidly through space
2) waves are absorbed, transferred, or reflected depending upon substance's composition
3) fastest mode of heating

2. Apply the principles of heat energy to food preparation

a. identify physical and chemical reactions in food due to heat application BPS1-12-D3
1) examples of physical changes include melting ice and boiling water
2) chemical changes include baking a cake or cooking an egg

✓ b. determine the effect of temperature on cooking rate
1) temperature controls rate of chemical changes
2) higher temperatures increase the rate and force of molecular motion
3) general rule is that the rate of reaction doubles for every 10°C increase in temperature
4) food must be cooked to and held at high enough temperature to kill disease-producing microorganisms

5) refrigerator or freezer storage slows molecular motion and reduces rate of food spoilage

c. recognize the effect of surface area on cooking rate

1) size of surface area determines how quickly heat energy can be absorbed

2) air or water molecules surrounding the food collide with the surface and transfer heat energy to the food molecules

3) molecules collide with and speed up slower molecules next to them

4) chain reaction continues inward until entire substance is warmed

5) the thicker the food, the longer the cooking time

d. differentiate between materials which affect energy transmission

1) metal pans and dishes: aluminum, stainless steel, copper, cast iron

2) glass pans and dishes: Corning Ware®, Pyrex, porcelain

e. experiment with different methods of transferring heat..... BPS1-12-D3

1) conduction is slow, direct transfer of heat energy between adjacent molecules: electric stove-top cookery, deep-fat frying, slow cooker

2) convection transfers heat through air or liquid currents by replacing less dense molecules with warmer ones: oven cookery, boiling, canning

3) radiation transfers high frequency, speeding waves to surface of substance where it is absorbed: broiling, toasting, charcoaling

4) microwave energy penetrates food where it's absorbed, transferred, or reflected

3. Determine the effect of heat energy upon textiles and apparel

✓ a. results in formulation of maintenance and care guidelines

1) Permanent Care Labeling Rule requires attached labels to specify how to clean and dry, including recommended water temperatures for textile products

2) compulsory testing standards verify customer's expectations of fiber properties

b. enhances or damages fibers

1) functional finishes requiring heat include flame resistance, wrinkle recovery, durable-press, and colorfastness

2) temperatures scorch, flame, melt, or shrink according to fiber identity

✓ c. transfers heat away from or toward body

1) conduction occurs when materials placed next to body act as a conductor to carry body heat to surrounding atmosphere where it is dissipated into the air and body is cooled

2) convection occurs when air currents move over and around body to carry body heat

3) body heat is lost through radiation when air temperature is lower than body temperature

4) heat loss by evaporation of perspiration occurs when body heat causes perspiration water to vaporize, or evaporate, thus cooling the body

4. Conserve energy for living space needs

a. take advantage of solar power

1) explain difference between active and passive solar systems

2) determine best orientation for house or addition to utilize sun's energy

3) recognize material resources conducive to solar energy

4) study placement of trees for cooling effect on home

b. convert electrical energy into heat and light

1) determine amount of energy (Btu's) used in a house/building

2) describe wiring of an electrical circuit

c. increase insulation

1) heat conduction reduced by wall and ceiling insulation

2) radiation diffused by window coverings, overhangs, exterior shutters

5. Analyze energy-saving appliances and equipment

a. compare features and benefits of a variety of appliances

1) read instruction booklet

2) check for UL label

3) locate model and serial number

4) interpret warranties

b. calculate cost of use

1) wattage

2) amperes and volts

3) horsepower

H. Studying the Importance of Acids and Bases..... BPS1-12-C1

1. Relate ionization to the formation of acids and bases BPS1-12-C2

a. review ionization process BPS1-8-D2

1) formation of charged particles called ions within a water solution

2) water ionizes to form positive hydrogen ions and negative hydroxide ions

3) equation written as $H_2O <—> H^+ + OH^-$..... BPS1-10-D1

4) solution considered neutral when an equal number of hydrogen and hydroxide ions are present

b. recognize an acid
   1) substance which releases hydrogen ions in solution
   2) acidic solution formed when hydrogen ions are greater in number than the hydroxide ions
   3) sour taste
   4) ability to turn litmus paper indicator red
   5) neutralization process occurs when acid reacts with a base to form water and a salt
   6) acid loses its properties when neutralization occurs
   7) examples include lemon juice, vinegar, gastric juice, hydrochloric acid

c. distinguish a base
   1) substance which produces hydroxide ions from remaining hydrogen and oxygen ions in water solution
   2) basic solution formed when hydroxide ions outnumber the hydrogen ions
   3) bitter taste and slippery touch
   4) ability to turn litmus paper indicator blue
   5) neutralizes acids
   6) base loses its properties during neutralization
   7) baking soda, lye, and milk of magnesia are examples

2. Express strength of substances by pH value
   a. interpret the pH scale
      1) chart indicating acidity or hydrogen ion concentration of a substance
      2) a scale of numerical values ranging from 1 (for very acid) to 14 (for very alkaline)
      3) the higher the concentration of hydrogen ions, the stronger the acids, and the lower the pH value
      4) each whole pH unit divided into tenths for greater accuracy
      5) substances with a pH less than 7 are acids
      6) substances with a pH greater than 7 are bases (alkaline)
      7) substances are neutral at pH of 7
   b. identify pH values of common substances
   c. experiment measuring pH
      1) electronic device called a pH meter used for precise measurements
      2) indicator paper such as litmus used to determine pH through color change

3) titration method used to find concentration of one substance by using a known volume and concentration (pH) of another substance

3. Comprehend chemical terms in order to calculate concentration of acids and bases
   a. distinguish chemical elements on a periodic table BPS1-8-B2
      1) elements with similar properties are placed in same vertical column on the chart
      2) each element has an atomic number and an atomic mass
   b. analyze the relationship between atomic mass and mole
      1) atomic mass is the sum of the mass of the protons and neutrons in the nucleus of an atom: Na is 23
      2) mole is a quantity term written 6.02×10^{23} M1-12-G1
      3) one mole of an element is the number of grams equal to the atomic mass of the element: mole of Na is 23 grams
      4) one mole of a compound is the number of grams equal to the sum of the atomic masses of the elements in the compound: mole of NaCl is Na (23g) + Cl (35.5g)=58.5 grams BPS1-10-D1
   c. calculate molarity (concentration) of a solution
      1) number of moles of solute contained in a liter of solution
      2) molarity is determined by dividing the number of moles of solute in solution by the volume of the solution in liters
      3) one-molar solution is written as 1.0 M
      4) molar solutions are prepared by massing grams of an element or compound, transferring to a liter flask, and adding water to the desired liter mark
4. Recognize the importance of pH for human body functioning ..... BPS 1-1 2-D3
   a. regulate blood at fairly constant pH level of 7.4
      1) carbon dioxide carried in the blood stream dissolves to form an acid and alters blood pH
      2) blood contains buffers of bicarbonate or phosphate ions which act as bases to neutralize excess acid formed by the carbon dioxide
      3) blood pH maintained by keeping the dissolved carbon dioxide and buffers in balance
      4) severe imbalance in blood pH can result in acidosis, excess acid, (lower than 7.2 pH) or alkalosis, excess base, (higher than 7.2 pH)
      5) hyperventilation occurs when person expels more carbon dioxide than necessary, upsetting the acid-base balance

b. aid in proper digestion of food

1) a variety of pH levels needed within the digestive system

2) stomach's main digestive acid is gastric juice which is highly acid (pH2)

3) enzymes need highly acid environment to digest protein

4) stomach acid so strong that lining of the stomach must secrete a thick, slimy mucus to protect itself

5) antacid tablets (basic) neutralize acid in stomach

6) small intestine enzymes need a neutral (pH7) environment to continue digestion of food

5. Distinguish the effect of pH on food BPS1-12-D3

a. determine leavening agent's effectiveness

1) two chemical leavening agents, baking soda and baking powder, produce carbon dioxide which causes baked products to rise

2) baking soda (alkali) must be combined with an acidic food and heated immediately to produce and retain carbon dioxide

3) acidic foods can be buttermilk, yogurt, sour cream, some fruits, fruit juices, and molasses

4) baking powder, a combination of baking soda, a dry acid, and cornstarch, is mixed with a liquid to give off carbon dioxide gas

5) double-acting or S.A.S. (sodium aluminum sulfate) baking powder releases some carbon dioxide in the cold mixture, but most is released when mixture starts to bake

6) use of baking soda with insufficient acid results in a baked product with a soapy, bitter flavor, a coarse texture, and a yellow color

7) excessive baking powder causes a coarse texture, off flavors, excessive surface browning, and an off-white color on the interior of the baked product

b. influence quality of prepared product

1) addition of acid, such as cream of tartar, lemon juice, or vinegar, increases stability of egg white foams

2) lemon juice or tomato juice are acids which can curdle case in protein in milk and cheese products when heated

3) acidic liquids such as lemon juice and vinegar help get rid of fish odors

4) phosphoric acid or citric acid give a refreshing tartness to soft drinks and fruit beverages

5) color of vegetables is retained by using an alkaline cooking medium for green vegetables and an acidic medium for red ones
6) texture of vegetables is deteriorated during cooking if pH rises or drops from 4 to 4.5
7) baking soda destroys vitamins and flavors in cooked vegetables
8) tomatoes, sour cream, vinegar, and lemon juice are acids used to tenderize meat
9) acid is needed to combine with the fruit pectin to form a stable gel in jelly making

c. provide safety in preservation
1) foods with pH greater than 4.6 are considered low-acid and provide ideal environment for rapid growth of deadly botulinum microorganism
2) pressure canning method is required for low-acid foods to provide higher temperatures needed to kill microorganisms
3) addition of lemon juice or citric acid increases acidity of food, making it safer for canning

d. ensure quality of ingredients in storage
1) bacteria (pH7), mold (pH2 to pH8.5), and yeast (pH4 to pH7) cause food spoilage
2) acid foods do not spoil as quickly as other foods
3) vegetables, with pH above 4.6, more often spoiled by bacteria
4) most fruits, with pH below 4.6, often attacked by yeasts and molds
5) stored eggs lose carbon dioxide through shell causing a breakdown in structure and an increase in alkalinity

6. Acknowledge use of acids and bases on textiles and apparel BPS1-12-D3
a. create synthetic fibers
b. apply as fabric finishes to improve appearance, feel, and/or performance of product
1) bleaching uses an acid to remove any natural color from fibers and fabrics prior to dyeing and printing
2) caustic soda used for mercerization of cotton, linen, and rayon to increase luster, strength, absorbency, and dyeability of fibers
3) ammonia (base) used to produce antistatic finish which prevents buildup of static electricity
4) flame resistance achieved through use of acids to prevent fabric from supporting or spreading a flame

5) sulfonic acid used to create moth-resistant finish
6) water-repellent finish created with use of chemical bases
7) acid dyes used to color wool, silk, acrylic, and nylon

c. provide care and maintenance of fabrics
1) cleaning and stain removal requires knowledge of fiber identity
2) acetone, found in fingernail polish remover and some paint removers, dissolves acetate
3) vinegar (dilute acetic acid) weakens acetate and nylon
4) strong acids damage cotton, linen, rayon, nylon
5) chlorine bleach (base) dissolves silk and wool, and yellows spandex
6) cresol, found in household disinfectants and antiseptics, weakens polyester, acetate, nylon, and spandex
7) olefins are resistant to acids and bases
8) cleaning ability of hard water improved by adding detergent with phosphates

7. Realize the use of acids and bases in the world around us
a. recognize most household cleaning agents as alkaline (basic)
1) soap
2) ammonia (pH12)
3) lye (pH13)
4) detergent

b. check for safety of water
1) drinking water tested for presence of harmful chemicals
2) swimming pools checked for proper pH to prevent spread of bacteria while still being safe for human use

c. identify as basis for fertilizers for home and garden
1) phosphoric acid
2) ammonium sulfate
3) sodium nitrate

d. produce electrical current in batteries

I. Protecting Health Through Effective Sanitation PDH2-8-TI

1. Recognize the need for sanitation
a. creates and maintains healthful, or hygienic, conditions
b. protects personal health
c. affects food safety
d. helps prevent textile deterioration

e. provides aesthetic and pleasing product appearance

2. Acknowledge microorganisms as the leading cause of food contamination BPS1-8-M1

✓ a. examine bacteria PDH2-8-T2

1) found in air, soil, water, and food
2) classify by shape: cocci, bacilli, spirilla
3) thrive in warm, moist, slightly acidic (4.6pH to 7pH) environment
4) grow and reproduce rapidly by division
5) may form spore cells which are difficult to kill
6) excrete wastes, sometimes toxic
7) can kill majority with temperatures over 140°F (60°C)

b. recognize molds

1) appear as fuzzy or powdery coating on food
2) prefer moist, dark, moderately warm environment
3) require air to survive
4) may produce harmful toxins
5) are inhibited by freezing and air circulation
6) can be killed by boiling temperatures

c. observe yeasts

1) appear as slime or discoloration on food
2) require sugar and moisture for survival
3) reproduce by budding process
4) can be detected by presence of bubbles and an alcoholic smell or taste
5) are killed by heating to 136°F (57.8°C) for fifteen minutes
6) can serve beneficial functions: bread leavening, product fermenting

d. be wary of viruses

1) are transported to humans via food, polluted water, and unsanitary personal hygiene habits
2) reproduce only in a living host
3) appear more heat resistant than most bacteria
4) cause a variety of viral diseases: hepatitis, influenza
5) transfer disease to food via unsanitary foodhandlers

e. detect parasites

1) are small or microscopic creatures
2) survive by invading a living host and reproducing
3) are killed by heating to high temperatures or freezing
4) are transported to humans via undercooked meat, particularly pork

3. Determine other means of contaminating food
   a. distinguish chemical substances BPS2-12-F1
      1) cleaning compounds
      2) pesticides
      3) additives
   b. detect physical substances
      1) glass
      2) metal
      3) other foreign objects
4. Identify the most common foodborne illnesses PDH2-8-T1
   a. defined as any disease transmitted to humans by food PDH2-10-T2
   b. referred to commonly as "food poisoning"
   c. called intoxications: illness caused by eating toxic (poisonous) plants and foods or foods containing toxic waste products of microorganisms
      1) staphylococcal (STAF-uh-lo-kahk-al) intoxication: caused by eating food containing staphyloccus aureus (OR-ee-us) toxin
      2) perfringens (pur-FRIN-jens) poisoning: caused by eating food contaminated with abnormally large amounts of clostridium perfringens (klahs-TRID-ee-um pur-FRIN-jens) toxin
      3) botulism (BOTCH-u-lism): caused by eating food containing deadly clostridium botulinum (klahs-TRID-ee-um BOTCH-u-li-num) toxin
   d. denoted as infections: illness caused by eating food containing living disease-producing microorganisms PDH2-10-T2
      1) salmonellosis (sal-muh-nel-OH-sis): caused by eating food contaminated with salmonella bacteria or by coming in contact with a human salmonella carrier
      2) trichinosis (trih-kuh-NO-sis): caused by eating food containing the trichinella spiralis (trih-kuh-NEL-uh spuh-RAL-is) animal parasite
5. Distinguish how to keep food safe PDH2-8-K3
   a. recognize multiple opportunities for food contamination PDH2-8, 10-T3
      1) can begin at the source through mishandling or poor control methods by the grower, processor, canner, or packer
      2) is possible as products go through intermediaries such as distributors and storage companies
      3) occurs most often at the final stage of production—the food-service operation

b. show concern for microorganism characteristics
   1) prosper in a moist, warm, nutritious environment such as protein-rich foods
   2) flourish at room and human body temperatures between 45°F and 140°F (7.2°C and 60°C)
   3) multiply to enormous numbers in a very short time
   4) slow down or stop growing by refrigeration
   5) can be destroyed by sufficient heat such as the normal cooking process
c. identify potentially hazardous foods
   1) includes any food which supports rapid and continuous growth of microorganisms
   2) has a pH of 4.6 or higher
   3) has a water level of 0.85 or higher: amount of moisture available to aid in bacterial growth
   4) identified as milk and milk products, eggs, meat, poultry, fish, shellfish, edible crustacea, baked or boiled potatoes, tofu, and other soy-protein foods, as well as synthetic ingredients
d. select high quality foods
   1) purchase from safe sources
   2) inspect food for sanitary quality, damage, proper temperatures
   3) rely upon government inspections and regulations
e. store foods properly
   1) adhere to "First In, First Out" (FIFO) rule: use in order purchased or received
   2) keep perishable, potentially hazardous foods out of the temperature danger zone, 45°F to 140°F (7.2°C to 60°C)
   3) store in areas that are clean and used only for food storage
   4) follow recommended times, temperatures, and procedures for storing
f. prepare foods according to recommended procedures
   1) adhere to the time-and-temperature principle: keep the internal temperature of food below 45°F (7.2°C) or above 140°F (60°C)
   2) pass through temperature danger zone as few times and as quickly as possible
   3) inspect and clean raw ingredients
   4) cook or heat-process food to recommended temperatures

5) be extra careful when preparing food for special occasions such as outdoor meals or parties
6) guard against cross-contamination from raw to cooked and ready-to-serve foods via hands, equipment, and utensils
7) refrigerate leftovers promptly and properly
8) reheat leftovers quickly to 165°F (73.9°C) or higher
9) clean and sanitize food contact surfaces after each use

g. serve food correctly
1) keep hot foods hot, above 140°F (60°C)
2) keep cold foods cold, below 45°F (7.2°C)
3) handle dishes and utensils in a sanitary manner
4) check serving dishes and tableware for soil or damage
5) follow rules for serving of self-service foods
6) wash hands between cleaning and serving of foods

h. train foodhandlers in personal hygiene
1) expect reasonably good health
2) keep hair and body clean to eliminate bacteria
3) wash hands thoroughly after coughing or sneezing, touching hair or face, using toilet, or handling raw food
4) trim and clean fingernails; avoid polish
5) bandage cuts and sores or avoid handling food until injury heals
6) refrain from smoking, eating, or chewing gum in food preparation or service areas
7) wear clean clothing or uniforms
8) restrain hair with hairnets, bands, or caps
9) avoid wearing jewelry which collects soil and may become caught in machinery
10) refrain from using wiping cloths to remove perspiration
11) restrict ill or injured persons from preparing and serving food

i. monitor kitchen facilities
1) design facility for cleanliness
2) select and arrange equipment to comply with sanitation standards
3) provide safe and adequate hot water supply
4) use clean cookware, kitchen tools, cutting boards, and dishes
5) wipe up food spills and crumbs promptly
6) change dishcloths and dishtowels frequently

7) dispose of garbage regularly and properly
8) control insects, rodents, and other pests
9) store poisonous substances in properly marked containers away from food
10) organize a regular cleaning program

j. be aware of government rules and regulations..... PDH3-8-F2
1) differentiate between control of interstate commerce (federally regulated) and intrastate commerce (state and locally regulated) SS5-8-E3
2) oversee food processing and establish inspection guidelines for food-service operations: federal and state inspectors of Food and Drug Administration
3) provide mandatory inspection for wholesomeness and voluntary grading for quality: U.S. Department of Agriculture
4) compile a GRAS (Generally Recognized As Safe) list of substances other than additives considered safe to eat: FDA
5) monitor food labeling information: FDA
6) deal with food wholesomeness throughout the world: Food and Agricultural Organization (FAO), World Health Organization (WHO)

✓ 6. Transfer sanitation knowledge to the individual and the workplace..... PDH2-10-T2

a. be aware of disease-producing microorganisms PDH2-8, 10-T3
1) transmitted from person to person: coughing, sneezing, and personal contact
2) result in communicable diseases: common cold, mononucleosis, hepatitis, influenza, sexually transmitted diseases (STDs)
3) multiply in diaper pails, changing areas, bathroom, and restroom facilities
4) grow due to inadequate laundry facilities, lack of personal hygiene, and unsanitary living conditions
5) need to be eliminated in food preparation and serving areas
6) must be avoided in medical facilities: operating rooms, labs, equipment and supplies, clothing
7) require attention for proper waste disposal
8) must be controlled in PE locker rooms, health and fitness establishments, and public recreational areas: to prevent ringworm, athlete's foot, warts

b. recognize the effects of chemical substances SS5-12-C1
1) be aware of pesticide residue and wash raw foods thoroughly before eating
2) realize the necessity of washing clothing worn during pesticide application separately from other clothing

3) avoid mixing cleaning compounds, especially chlorine and ammonia, as noxious fumes may result
4) consider the effect of aerosol sprays upon respiratory problems
5) protect wool, wool blends, and animal fiber fabrics from moth and larvae damage with moth balls, flakes, or cakes
6) discourage use of monosodium glutamate flavor enhancer which causes allergic reactions in some persons
7) select fabrics treated with finishes to prevent mildew, mold, and fungus growth
8) avoid closed areas when car exhaust or charcoal fumes are present

J. Practicing Safety at Home, School, and Work PDH3-8,12-GI

1. Acknowledge that accidents can be prevented SS5-12-11

a. must develop a safety conscious attitude SS5-12-12

b. need to plan ahead for safety

1) eliminate safety hazards
2) maintain ready-to-use safety equipment and supplies

c. recognize risk factors that influence safety

1) being in a hurry
2) distraction
3) physical exhaustion
4) excitement
5) depression

d. put safety rules into action when necessary

✓ 2. Recognize and eliminate common safety hazards at home and work

a. identify opportunities for falls and bumps

1) floors
2) stairs
3) clutter

b. distinguish potential fire and electrical problems

1) matches
2) fireplaces
3) grease
4) outlets
5) appliances
6) wiring

c. determine products which cause poisonings..... BPS2- 12-F

1) cleaning compounds
2) dishwashing detergents
3) laundry supplies
4) cosmetics
5) plant and lawn gardening materials
6) shop and hobby cleaners and supplies
7) medicines

d. acknowledge dangers from cuts
1) kitchen knives and sharp cooking utensils
2) hobby and craft tools
3) workroom saws and tools
4) outdoor tools and machinery

3. Accept responsibility for personal safety
a. be aware of clothing and uniforms
1) avoid long, loose-fitting clothing which may catch on fire, interfere with working, or become caught in moving equipment
2) restrain hair and remove loose jewelry
3) wear protective clothing when necessary
b. pay attention to personal hygiene
1) wear shoes to protect against cuts, slips, or falls
2) protect eyes when applying cosmetics and skin and hair care products

4. Take responsibility for the safety of others SS5-10-E3 SS5-8, 10-H1
a. post phone numbers for appropriate emergency agencies PDH3- 12-11
b. watch children closely
1) never leave young children alone
2) store knives, guns, matches, medicines, and household chemicals in high places or locked cabinets
3) keep cabinet doors and drawers closed
4) teach children basic safety rules
5) lock or remove doors of old refrigerators or freezers
6) adhere to child seat restraint laws
c. show concern for the elderly
1) realize the body changes with age: seeing, hearing, reacting, healing
2) protect against falls: use appropriate step stools, provide carpeting
3) provide good lighting

4) encourage use of security monitoring systems

d. help individuals with handicapping conditions

1) equip home or work station with easy-to-use and easy-to-clean equipment

2) provide easy access to rooms, especially bathroom

3) install hand rails in stairwells and bathtubs

5. Show concern for environmental safety PDH3-8-K3

a. determine safety of water supply PDH3- 12-K1

b. identify causes of air pollution and safety checks being imposed by government regulation

c. anticipate effect of heavy demands on waste disposal sites

1) aerosol containers

2) disposable diapers

3) toxic wastes

4) poisonous household substances

d. promote and encourage recycling

6. Prevent and control fire

a. formulate plan for protecting yourself and others in event of fire

1) draw up fire escape route

2) hold a practice drill

3) memorize telephone number to notify fire department

4) install and maintain smoke detectors

5) affix decals to bedroom windows to designate occupants

6) assess your skill and ability to respond to various types of fires

b. recognize the three elements necessary to produce a fire

1) fuel to burn

2) heat to bring fuel to a kindling point

3) oxygen to keep fuel burning

c. realize elimination of one element will extinguish fire PDH3-8-G2

1) remove fuel

2) cool

3) cut off or smother air supply

d. identify types of fire and best method of extinguishing

1) Class A: ordinary combustibles such as wood, rubbish, cloth, or paper—cool with water

2) Class B: flammable liquids such as gasoline, oils, greases, paints, and kitchen fats—smother and never use water

3) Class C: electrical equipment such as in generators, motors, defective wiring, and appliances—smother and avoid water for fear of electrocution

e. select and use the correct fire extinguisher

1) identify a variety of types: water, carbon dioxide, dry chemical, and halon gas

2) read label to determine what class of fire and select extinguisher accordingly

3) practice using while noting limitations of each type

f. determine safety procedures in event of fire

1) smother small grease fire by covering with a lid, applying salt or baking soda to the flames, or using a fire extinguisher designed for grease fires

2) stop, drop, and roll if clothing catches on fire; roll in a blanket if possible

3) contain fire to a burning room by closing doors and windows to cut off air supply

4) escape through window or hallway door after first testing door for warmth

5) crawl along floor keeping head down in case of a smoke filled room

6) tie a wet towel or handkerchief over nose and mouth to avoid smoke inhalation

7. Become familiar with first aid procedures..... PDH2-12-R1

a. follow standard first aid procedures PDH7-8-C5

1) acquire training

2) update skills periodically

3) practice latest techniques to prevent spread of communicable diseases such as AIDS or hepatitis

b. prevent infection of minor wounds: cuts, burns, bruises, stings, or bites

1) wash hands with soap and clean water

2) cleanse wound

3) apply sterile dressing or bandage

c. recognize and treat shock..... PDH7-8-C4

1) look for signs: weakness, rapid pulse, pale skin that is moist and cooler than normal, frequent nausea or vomiting, and shallow breathing

2) keep victim lying down

3) cover to conserve body heat

4) get medical help as soon as possible

d. deal with choking..... PDH7-8-C3

1) recognize Universal Distress Signal
2) apply Heimlich Maneuver if possible

e. provide rescue breathing
1) administer mouth-to-mouth resuscitation
2) perform CPR only by trained persons

f. treat poisonings promptly
1) call doctor, hospital emergency room, or poison control center; follow instructions
2) save label or container of suspected poison
3) dilute poison with water or milk
4) induce vomiting unless poison is strong acid or alkali or a petroleum product such as gasoline
5) keep airway open if victim becomes unconscious

8. Handle emergency situations at home, school, work PDH7- 10-C1
a. respond in calm, controlled manner PDH7-12-C1
b. check breathing and clear airway if necessary SS5-8, 10-J2
c. control severe bleeding
1) apply direct pressure on wound
2) elevate body part so it is above level of person's heart
d. rescue promptly
1) move victim only when necessary to save life
2) cover to prevent chilling and shock
e. seek medical help PDH7-10-C3
1) give address, telephone number
2) provide description of the problem
f. realize and accept limitations and abilities

9. Recognize safety hazards in a variety of situations PDH7-12-C2
a. pay special attention to holidays
1) Halloween
2) Christmas
3) Fourth of July
b. realize need for safety on the street
1) automobiles
2) bicycles
3) motorcycles
4) pedestrians

c. promote safety in sports and recreation
   1) toys and play equipment
   2) camping
   3) hiking
   4) outdoor cooking
   5) snowmobiling
   6) boating
   7) water skiing
   8) swimming
   9) guns and ammunition

d. acknowledge maintenance hazards
   1) lawn mowers
   2) pesticides
   3) tools
   4) waste disposal
   5) flammable fluids

III. IDENTIFYING JOB/CAREER OPPORTUNITIES USING SCIENCE-RELATED HOME ECONOMICS

A. Investigating Food and Nutrition Services
   1. Provide food and nutrition services
      a. fast-food worker
      b. kitchen helper
      c. cook/chef
      d. food server
      e. meat cutter
      f. caterer
      g. manager
      h. entrepreneur
      i. dietetic technician
      j. public health inspector
      k. homemaker
   2. Promote health and science concepts
      a. Peace Corps volunteer
      b. home economist
      c. dietitian

d. food editor
e. wellness center educator
f. county or state Cooperative Extension Service agent

3. Develop quality foods and sanitation practices through research and technology
   a. government agency inspector
   b. food tester
   c. packer/distributor
   d. biochemist
   e. test kitchen specialist
   f. food scientist
4. Work with foods and sanitation
   a. sensory evaluator
   b. biotechnologist
   c. quality control specialist
   d. manager
   e. cleaner
   f. entrepreneur

B. Considering Health and Human Services
1. Care for children, adults, and elderly
   a. physician/specialist
   b. nurse
   c. child or day care worker
   d. physical therapist
   e. home health aide
   f. social worker
   g. recreation worker
2. Administer and manage services
   a. clinic director
   b. nursing home/child care director
   c. teacher
   d. hospital administrator
   e. government agency employee
3. Recognize health care providers
   a. public health director
   b. medical technician
   c. environmental inspector

d. family-life educator
e. dietitian
f. wellness director
g. home economist
h. nutritionist

4. Provide personal and public services
   a. water treatment specialist
   b. laboratory technician
   c. paramedic
   d. trash collector
   e. dental aide
   f. fire fighter
   g. consumer advocate
5. Offer health and cosmetic services
   a. esthetician
   b. cosmetologist
   c. barber
   d. nail technician
   e. makeup artist

C. Examining Living Environment and Interior Furnishings Services
   1. Serve people with living space needs
      a. paint sales associate
      b. interior designer
      c. color analyst
      d. environmental scientist
      e. building maintenance engineer
      f. real estate agent
   2. Develop ideas to enhance living space
      a. landscape architect
      b. product designer
      c. interior designer
      d. contractor
      e. wallpaper designer
   3. Manipulate data to promote housing
      a. community planner
      b. engineer

c. architect
d. surveyor
e. hardware buyer
f. contractor

4. Maintain buildings and environment
   a. building inspector
   b. furniture refinisher
   c. horticulturist
   d. janitor
   e. groundskeeper
   f. sanitarian

D. Distinguishing Textile and Apparel Services
   1. Assist through personal services
      a. salesperson
      b. cosmetologist/barber
      c. color consultant
      d. product/business representative
   2. Advertise or develop products
      a. fashion editor
      b. media illustrator
      c. photographer
      d. home economist
      e. fashion designer
      f. textile designer
      g. researcher
      h. sample maker
   3. Ensure quality and safety
      a. quality control specialist
      b. textile chemist
      c. textile conversion manager
      d. market research analyst
      e. government agent
   4. Care for and treat textile products
      a. dry cleaner
      b. launderer
      c. weaver

d. tailor/alterationist

E. Recognizing Hospitality and Management Services

1. Assist through personal services
   a. residential interior designer
   b. commercial designer
   c. lighting and electrical designer
   d. chef
   e. dietitian
2. Ensure quality and safety
   a. quality control technician
   b. food consultant specialist
   c. food product manager
   d. supermarket manager
   e. resort manager
   f. management trainee
3. Care for and treat environment
   a. cleaner
   b. landscape designer
   c. environmental consultants

F. Exploring the Training and Education Necessary for Various Jobs/Careers

1. Acquire personal experience
2. Achieve high school diploma
3. Take advantage of apprentice or trade school program
4. Earn technical or vocational degree
5. Attain college degree

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II 1 5 a	Recognizing Multiple Opportunities For Food Contamination	SA-169
II 1 6 a	Transfering Sanitation Knowledge to the Individual and the Workplace	SA-173

SAFETY

II J 2	Recognizing and Eliminating Common Safety Hazards at Home and Work	SA-177

JOB/CAREER

III A 4 a	Foods and Sensory Evaluating	SA-183

ACTIVITY FORMAT

COURSE TITLE
Topic
Outline Reference

TITLE: This duplicates the wording from the course content outline.

OBJECTIVES: The first objectives identify knowledge students are expected to acquire. The remaining objectives emphasize skills incorporated throughout the activity. These skills were developed from the task lists.

MATERIALS: Assemble and prepare all materials prior to beginning instruction. Materials used repeatedly are located at the beginning of the activities section.

INTRODUCTION: This is an overview of the activity's content.

DIRECTIONS: Suggested procedures for student to perform are included.

EVALUATION: These are suggestions for determining the achievement of the objectives. The criteria for assigning grades is not included.

FHA-HERO: This section suggests ways to incorporate the lesson's content into FHA-HERO activities and proficiency events.

TEACHER NOTES: Additional ideas and suggestions for further application of the content are identified.

STATE GOALS: If the activity is taught as written, the identified state goals will be met.

CREATIVE THINKING PROCESS

Directions: Apply the steps in this process to make discoveries.

1. **MAKE OBSERVATIONS:** Reveal a problem to solve or a mystery to explain.

2. **FORM HYPOTHESIS:** Predict a solution or make an educated guess.

3. **TEST HYPOTHESIS:** Conduct experiment and record data.

4. **DRAW CONCLUSIONS:** Interpret data; retest if necessary.

5. **EVALUATE RESULTS:** Alter of refect hypothesis or accept as theory.

THE DECISION-MAKING PROCESS

Directions: Apply the steps in this process to make a decision.

1. **DEFINE PROBLEM:** Be specific and it will be easier to solve.

2. **GATHER INFORMATION:** Use a variety of resources.

3. **WEIGH ALTERNATIVES:** Consider pros and cons of each idea.

4. **MAKE DECISION:** Select decision which is best for you, others, and the environment.

5. **EVALUATE DECISION:** Judge the outcome and consider whether to repeat.

LAB REPORT FORM

Scientific Method

Date_____ Class Period_____ Name_____

Complete this section before conducting experiment.

1. Make Observations	**Title of Experiment:** **Partner/s:** **Purpose of Experiment:**
2. Form Hypothesis	**Hypothesis:**

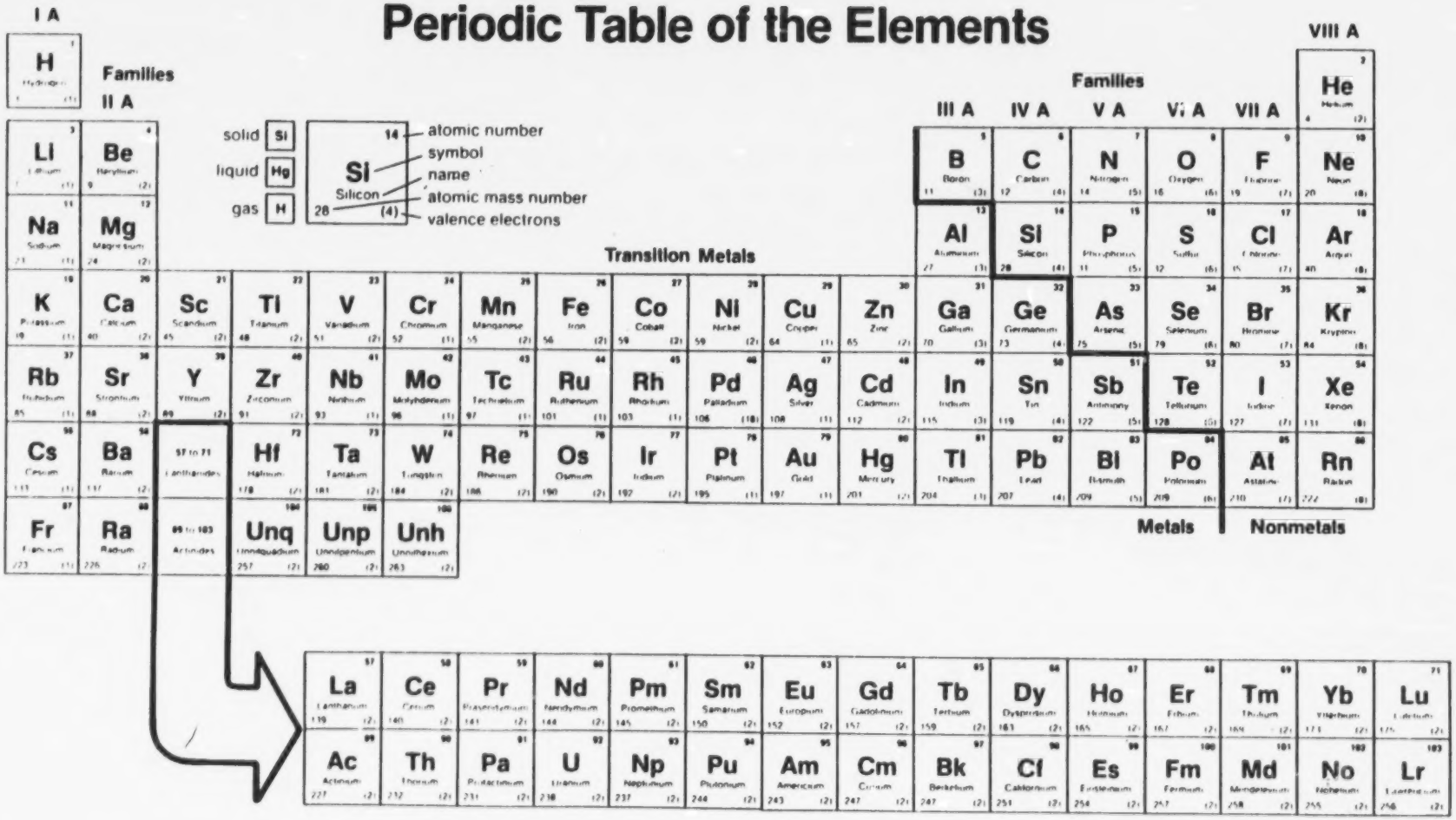
Complete this section during and after the experiment.

3. Test Hypothesis	**Experiment Procedure:** **Observations:** **Data:** Attach completed data table to this report.
4. Draw Conclusions	**Calculations:** **Questions:** Attach answers to this report if more space needed.
5. Evaluate Results	**Conclusion:** Accept or reject hypothesis?

Attach experiment worksheet, data table, calculations, answers to questions, and any others to this form before turning in to your instructor.

SA-7

Periodic Table of the Elements



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RECOGNIZING INNOVATIONS AFFECTING THE INDIVIDUAL, FAMILY, AND WORKER

OBJECTIVES:

Develop awareness of science and technology's impact upon everyday life.
Identify where to locate and how to use information.
Relate to and communicate with others.

MATERIALS:

How Are You Affected by . . . ? transparency
One copy of above transparency as a handout for each student
One copy of **What's In the News?** report form for each student

PREPARATION:

None

PROCEDURE:

1. Introduce activity by stating the following: "How could we get along today without the microwave oven or the VCR or plastic? It's hard to believe a world without these items and yet they all came about because someone recognized a problem and set out to discover a solution. We call these people scientists, and their solutions are often in the form of technology. Science and technology have affected and continues to affect us and everything in our life."
2. Display **How Are You Affected by . . . ?** transparency. Ask students for specific examples of innovations under the six headings. Expand their responses with information from the content outline (I A 1-6).
3. Have students brainstorm problems that scientists are currently trying to solve. List these on a transparency or the chalkboard. Distribute **How Are You Affected by . . . ?** handout and **What's In the News?** report form.
4. Ask students to locate articles related to any of the six headings in newspapers or magazines and bring copies of the articles to class throughout the semester. Students will give brief oral reports summarizing the content of these articles and complete the **What's In the News?** report form.
5. Assign students to interview their parents or grandparents to find out how science and technology have changed their lives since they were children. Consider any or all of the six areas of innovations.
6. Have students volunteer to give oral reports of their interviews.

EXPECTED DATA:

Will vary.

EVALUATION:

Completed in Steps 4, 5, and 6 of procedure.

TEACHER NOTES:

A timeline could be produced by the students to illustrate innovations and progression of events, ideas, and products. Add to it throughout semester. Guest speakers would be appropriate.

STATE GOALS:

BPS2-8,12-A2; BPS2-8-B2; BPS2-8,10-C3; BPS2-8-D1; BPS2-8,12-E2; BPS2-8-A3; BPS2-8-G1; BPS2-8-H1; BPS2-8,12-H2; BPS2-10-A1; BPS2-10,12-C2; BPS2-10-F3; BPS2-10-H4; BPS2-12-C1; BPS2-12-E1; BPS2-12-F1; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-C1; LA1-8,10,12-C2; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-F1; LA1-8,10,12-G1; LA2-8-C2; LA2-8-C3; LA2-8,10-D1; LA2-8-D2; LA2-10-D3; LA2-8,10,12-F1; LA2-8,10,12-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10,12-B1; LA2-10,12-B2; LA2-10-B3; LA3-8,10,12-A2; LA3-8,10-A3; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8,10-B3; LA4-8-C1; LA4-8,10-C2; LA4-8,12-D1; LA4-8,10-D2; LA4-8-E2; LA6-8-A1; LA6-10-C1; LA6-8,10-C2; SS1-10-O2; SS4-8-G2; SS4-8-H1; SS4-8-I2; SS4-8-I3; SS4-8-I4; SS4-10-G3; SS4-10-G4; SS5-12-C1; SS5-12-D1; SS5-12-H1; SS5-12-K1; SS5-12-M5.

HOW ARE YOU AFFECTED BY . . . ?

FOOD ADVANCES

Food Presentation
Product Restructuring
Convenience Packaging
Microwave Cooking

TEXTILE AND CLOTHING CHANGES

Synthetic Fabrics
Computer Design and Construction
Fabric Finishes

HUMAN DEVELOPMENT PROGRESS

Disease Prevention
Fetal Development
Nutrition Research
Physical Fitness Equipment
Drug Development

HEALTH, FITNESS, AND IMAGE VARIATIONS

Product Claims
Skin Care Products
Vitamin and Food Supplements
Hair Treatments
Cosmetic Surgery

HOUSING TECHNOLOGY

Mass Production
Solar Energy
Construction Materials
Computer-Aided Design

MANAGEMENT INNOVATIONS

Telecommunication
Audiovisual Equipment
Computers
Fax
Robots
Calculators

WHAT'S IN THE NEWS ?

Report Form

Name _____

Date _____ Period _____

Directions:

1. Locate articles in newspapers or magazines which represent scientific or technological items affecting you and your environment.
2. Turn in one original copy of a current article per term.
   a. No duplication of the same article within the course.
   b. All articles accepted on a first-come basis.
   c. This means a total of two articles per semester.
3. Attach article to summary sheet. Hand in no later than two weeks before the end of the grading period.
4. Give oral report at beginning of class on the day it is due.
5. Post a copy of the article on bulletin board. Article will not be returned.

Title: _____ **Author:** _____

Date: _____ **Source:** _____

MAIN IDEA: _____

_____

_____

_____

SUMMARY: _____

_____

_____

_____

IMPLICATIONS FOR CONSUMER: _____

_____

_____

_____

Courtesy of *Food Science Curriculum*, Victor J. Andrew High School, Tinley Park, IL

DEALING WITH INDIVIDUAL RESPONSIBILITY IN A SCIENTIFIC AND TECHNOLOGICAL SOCIETY

OBJECTIVES:

Develop an awareness of your responsibility in utilizing science and technology.
Relate to and communicate with others.

MATERIALS:

One copy of **What's My Responsibility?** handout for each student
Two 250 mL beakers
Blue food coloring
Hot and cold water

PREPARATION:

None

PROCEDURE:

1. Introduce activity by conducting the following demonstration:
   a. Fill a large beaker with cold water and place it in front of the classroom. Tell students this represents clean water or air.
   b. Ask students what happens when a pollutant is added?
      1) Gently add several drops of blue food coloring to the water.
      2) Hold a sheet of white paper behind the jar for ease of viewing.
      3) Observe food coloring spread out.
      4) Note how much time it takes for the coloring to spread through the water.
   c. Try the same procedure with a jar of warm water.
   d. Point out that pollutants in water and air may, at first, be in only one place, but they spread rapidly.
   e. Have students respond to the question, "What is our responsibility regarding pollution of our resources?"
2. Distribute **What's My Responsibility?** handout.
3. Generate classroom discussion by having students read and respond to how the situations would affect them and what their responsibility would be in dealing with science and technology.
4. Emphasize areas of concern from the content outline (I B 1-2).
   a. Show concern for the environment.
   b. Address ethical decisions.
5. Ask students to speculate about how the present use of resources and decisions regarding science and technology will affect the quality of life for their children.

EXPECTED DATA:

Responses will vary.

EVALUATION:

Completed in Steps 3 and 5 of procedure.

TEACHER NOTES:

Encourage students to look beyond themselves and imagine how science and technology will affect all ages and all parts of the world.

STATE GOALS:

BPS1-8,10,12-E2; BPS1-10-D4; BPS1-10-G1; BPS1-10-I3; BPS1-12-E1; BPS1-12-M3; BPS2-8,10,12-B2; BPS2-8,10-B3; BPS2-8-B4; BPS2-8,10,12-C2; BPS2-8,10-C3; BPS2-8-D1; BPS2-8,12-E1; BPS2-8,12-F1; BPS2-8,10-F2; BPS2-8-G1; BPS2-8-G2; BPS2-8,12-H2; BPS2-10,12-A1; BPS2-10,12-B1; BPS2-10-E3; BPS2-10-F3; BPS2-10-F4; BPS2-10-H3; BPS2-10-H4; BPS2-12-A2; LA1-8,10,12-A1; LA1-8,10, 12-A2; LA1-8,10,12-A3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8,10,12-C2; LA2-8-D1; LA2-8-D2; LA2-8-E3; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10,12-B2; LA4-8-A1; LA4-8,10-C2; LA4-8,12-D1; LA4-8-D2; LA4-10-E5; LA4-12-E2; LA4-12-E3; LA6-8-A1; LA6-10-C1; LA6-8,10-C2; M6-8-A1; M6-10-E1; PDH2-12-P2; PDH3-8,10-K2; PDH3-8-K3; PDH3-8,10, 12-L1; PDH3-8,10-L2; PDH3-8-L3; PDH3-8,10,12-M1; PDH3-10,12-K1; PDH3-10-M2; SS1-8-H1; SS1-8-M2; SS1-10-B1; SS1-10-O2; SS1-12-M1; SS2-8-B1; SS2-8-B2; SS4-8-D2; SS4-8-H1; SS4-8-I4; SS4-8-J2; SS4-10-G3; SS4-10-G4; SS4-10-H4; SS4-10-H5; SS4-10-I1; SS4-10-I2; SS4-12-J1; SS5-8-A2; SS5-8,12-C1; SS5-8-D2; SS5-10,12-H1; SS5-10-H4; SS5-10-L1; SS5-10-M2; SS5-12-K1; SS5-12-M5.

Courtesy of *Life Science*, Addison-Wesley Publishing Company

WHAT'S MY RESPONSIBILITY?

Handout

- Burger King, McDonald's, and Wendy's have all announced that they are cooking their French fries in 100% vegetable oil. No more 90%+ artery-clogging beef fat. No more fries with more saturated fat than hamburger. How does this decision affect their image? Will it affect you?

- A thirty-two year old man has Hodgkin's disease and has a good chance of being cured with intensive treatment. He is unemployed and uninsured, and, even though he has felt sick for months, he only came to the emergency room when his breathing was severely labored. What do we do about young patients who need the sophisticated treatment but often cannot afford it? How much high-tech medicine can we pay for? How much of it is, in fact, needed?

- The noise level has risen steadily in the twentieth century, increasing both stress and hearing loss in individuals. Experts report that loud music already is causing permanent damage to the hearing of many young people. What jobs might expose you to high levels of noise?

- In March, 1989, the oil tanker Exxon Valdez struck a reef after leaving the port of Valdez, Alaska. A very large oil spill resulted. What long-range and short-range decisions led to the disaster? How does this disaster continue to affect us today?

- Insects reduce worldwide food production by 25% to 35%. Insects are also carriers of a large number of diseases that make us miserable. A variety of chemical pesticides have been used to control insect populations in food supplies. Is there any reason to be concerned about pesticides?

- An 85 year-old woman has been suffering from the complications of acute leukemia and its treatment. She has received dozens of transfusions of scarce blood products and numerous medications. Throughout her extended hospitalization, expensive blood tests, X-rays, and CAT scans have been performed to diagnose her problems. She may require further hospital admissions in the future. How much sophisticated medical treatment is worthwhile for the debilitated aged? What effect will a growing number of elderly have upon society and the health industry?

IDENTIFYING THE STEPS OF THE SCIENTIFIC METHOD AND CORRELATING THEM WITH THE DECISION-MAKING PROCESS

OBJECTIVES:

Interpret the steps of the scientific method.
Distinguish the correlation of the decision-making process with the scientific method.
Identify where to locate and how to use information.

MATERIALS:

Scientific Method transparency (located at beginning of **LIVING SCIENCE** Activities)
Decision-Making Process transparency (located at beginning of **LIVING SCIENCE** Activities)
One copy of **Check Your Scientific Method Vocabulary** worksheet for each student

PREPARATION:

None

PROCEDURE:

1. Introduce the activity by stating the following:
   "How do scientists make new discoveries? Do they suddenly wake up with new ideas? Are they lucky? All of these factors can be a part of scientific discovery. In addition, scientists are trained to observe and ask questions. Scientists search for answers to their questions in a systematic way. We call that process the scientific method."
2. Display the **Scientific Method** transparency.
   a. Cover and reveal one step at a time.
   b. Explain step-by-step how the scientific method is used to solve a specific problem. The following are examples:
      1) How many ways can you divide a pizza?
      2) Why won't the car start when you turn on the key?
   c. Stress the need for detailed and accurate observations before forming a hypothesis.
   d. Explain why scientists conduct experiments.
      1) Define the terms control and variable.
      2) Emphasize need to record data.
   e. Clarify that the word "theory" in the scientific world means an established, accepted idea and not speculation.
3. Explain that we make decisions every day. Whether we're aware of it or not, we use a specific method called the decision-making process. It is very similar to the steps of the scientific method.
4. Display **Decision-Making Process** transparency.
   a. Cover and reveal one step at a time.
   b. Explain each step and how it correlates to the scientific method by overlaying the two transparencies.
5. Distribute **Check Your Scientific Method Vocabulary** worksheet.
6. Discuss students' responses upon completion.

EXPECTED DATA:

Answers to **Check Your Scientific Method Vocabulary**:

1. C
2. G
3. E
4. B
5. K
6. I
7. L
8. D
9. J
10. A

11. make observations, form hypothesis, test hypothesis, draw conclusions, and evaluate results
12. in order to test and verify hypothesis
13. inaccurate observations lead to inaccurate hypotheses which do not stand up to testing
14. to determine the effect of one factor on an experiment
15. to organize information and make it easier to draw conclusions

EVALUATION:

Completed in Step 6 of procedure.

TEACHER NOTES:

Review the scientific method vocabulary in a variety of science books in order to explain terms concisely as you go through the five steps. Additional vocabulary may be added to include the decision-making process steps. The important thing is to see the correlation of the two.

STATE GOALS:

BPS1-8-B1; BPS3-8-B3; BPS3-10-A4; BPS3-10-B3; BPS3-10-B4; BPS3-12-A.B; BPS4-8-G1; LA1-8,10,12-D1; LA1-8,10,12-G1; LA2-8,10,12-B2; LA2-8,10,12-D1; LA2-8,10,12-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10-C3; LA3-8,10,12-B1; LA4-8-A1; LA4-8-D1; LA4-8-D2; LA6-10-C1; SS5-8,10-A1; SS5-8,10-B1; SS5-10-A2; SS5-10-A3.

CHECK YOUR SCIENTIFIC METHOD VOCABULARY

Worksheet

Directions: Match each description with the correct word from the list below in problems 1 to 10. Some words will not be used. Answer questions 11 to 15.

a. conclusion	**e. hypothesis**	**i. procedure**
b. control	**f. law**	**j. scientific method**
c. data	**g. observation**	**k. theory**
d. experiment	**h. problem**	**l. variable**

___ 1. the recorded facts from an experiment

___ 2. something learned through your senses

___ 3. a proposed solution to a problem

___ 4. a standard for comparison in an experiment

___ 5. an established, accepted idea

___ 6. the way an experiment is performed

___ 7. the factor that is being tested in an experiment

___ 8. a way of testing a hypothesis

___ 9. a series of steps that helps scientists solve problems

___ 10. the interpretation of data or retesting to arrive at a decision

11. List the steps in the scientific method.

_____

_____

12. Why must scientists do experiments?

_____

_____

13. Why are accurate observations necessary in forming a hypothesis?

_____

_____

14. Why do scientists use controlled experiments?

_____

_____

15. What is the purpose of a data table?

_____

_____

MAKING OBSERVATIONS

OBJECTIVES:

Practice the first step of the scientific method process.
Increase sensitivity of each of the senses.
Demonstrate responsibility for carrying out activity.

MATERIALS:

One copy of **What Do You Observe** worksheet for each student
Set of four 250 mL beakers per four to six students
Water
Sugar
Salt
White vinegar

PREPARATION:

1. Prepare a set of four beaker samples for every four to six students.
   a. Fill one beaker of each set with
      1) plain water (A)
      2) sugar (B)
      3) salt water (C)
      4) very dilute white vinegar (D)
   b. Label beakers A, B, C, D. Keep record of beaker contents.
2. All samples should appear clear.

PROCEDURE:

1. Introduce activity by explaining that people make observations all the time. To a scientist, making complete, accurate observations is the first step of the scientific method process. Scientists try to solve problems based on their observations, so it is important to make accurate observations, not inferences or interpretations. This activity will help you learn the skill of observation by training the mind and the senses to work together to consciously detect a greater number of things in the world around you.
2. Divide class into groups of four to six students.
3. Distribute worksheet and sets of beaker samples.
4. Review directions.
5. Students work independently within their groups.
6. Compile student observation data on chalkboard or transparency.
7. Reveal identity of beaker solutions.

EXPECTED DATA:

No data expected for sense of hearing or touching.

EVALUATION:

Completed in Steps 5 and 6 of procedure.

TEACHER NOTES:

It is important to make a clear distinction between observing and inferring. Students often make inferences when they observe and confuse these interpretations with the "facts" of the observation.

STATE GOALS:

BPS1-8-L3; BPS1-8-P3; BPS1-12-D3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8-B1; BPS3-8-B3; BPS3-8-B4; BPS3-8-B6; BPS3-10-B2; BPS3-10-B3; BPS3-12-A.B; BPS4-8-A1; BPS4-8-B1; BPS4-8-C1; BPS4-8-G1; BPS4-8-M1; BPS4-10-E1; BPS4-10-G1; BPS4-12-A.M; LA1-8,10,12-D1; LA1-8-E1; LA1-8,10,12-G1; LA1-8,10, 12-B3; LA3-8,10,12-B1; LA3-8,10,12-C1.

Courtesy of *Life Science*, Addison-Wesley Publishing Company

WHAT DO YOU OBSERVE?

Worksheet

Skillful observation often means thinking more about what you see, hear, taste, smell, or touch.

Directions:
1. Observe the four beakers of solution using all five senses, if possible.
2. Use only one sense at a time to examine the contents.
3. Write down all the specific details discovered while using that sense.
4. After observing with all five senses, identify the solution in each beaker.

	BEAKERS			
	A	B	C	D
What did you observe with the sense of SIGHT?				
What did you observe with the sense of HEARING?				
What did you observe with the sense of TASTE?				
What did you observe with the sense of SMELL?				
What did you observe with the sense of TOUCH?				
CONCLUSION: Identify the solution from your observations.				

SA-23

REALIZING THE TRANSFERABILITY OF THE PROCESSES TO A VARIETY OF PROBLEMS AND SITUATIONS: A

OBJECTIVES:

Apply the scientific method process to a problem.
Relate to and communicate with others.

MATERIALS:

One copy of **Scientific Method** worksheet for each student (located at beginning of **LIVING SCIENCE** Activities)
Slide projector
Scientific Method worksheet/transparency
Marker pen

PREPARATION:

Malfunction the slide projector so no light will be projected by either

1. removing the bulb, or
2. equipping with a burned-out bulb, or
3. inserting a black slide, or
4. leaving lens cover on the lens.

PROCEDURE:

1. Introduce activity by saying, "There's a mystery to solve. The scientific method will be used to explain the problem."
2. Distribute **Scientific Method** worksheet.
3. Turn on slide projector. No light should reach the screen.
4. Have students solve the problem of the malfunctioning projector by using the five steps of the scientific method.
   a. Students ask questions and suggest factors for you to investigate.
   b. All data is recorded on transparency and individual worksheets.
   c. Final conclusion is made, supported by the data.

EXPECTED DATA:

Responses to five steps of scientific method process:

1. No light projected.
2. Several possible hypotheses: no bulb, burned-out bulb, black slide, lens cover.
3. Test by asking questions and suggesting factors to investigate.
4. Determine actual cause of problem.
5. One hypothesis will be correct.

EVALUATION:

Completed in Step 4 of procedure.

TEACHER NOTES:

Any problem or mystery may be used to illustrate the scientific method steps. This activity may be used as an introduction or summary to the scientific method.

STATE GOALS:

BPS1-8-P3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8-B1; BPS3-8-B4; BPS3-8-B6; BPS3-10-B2; BPS3-10-B3; BPS3-12-A.B; BPS4-8-A1; BPS4-8-G1; BPS4-10-C1; BPS4-10-D1; BPS4-10-G1; BPS4-10-I1; BPS4-12-A.M; LA1-8,10,12-D1; LA1-8-E1; LA1-8,10,12-G1; LA1-8,10,12-B3; LA3-8,10,12-B1; LA3-8,10,12-C1.

Courtesy of *Biology: An Everyday Experience*, Merrill Publishing Company

REALIZING THE TRANSFERABILITY OF THE PROCESSES TO A VARIETY OF PROBLEMS AND SITUATIONS: B

OBJECTIVES:

Apply the scientific method to make a discovery.
Interpret data.
Record data using a graph.
Demonstrate responsibility for carrying out activity.

MATERIALS:

One copy of **Scientific Method** worksheet for each student (located at beginning of **LIVING SCIENCE** Activities)
Scientific Method transparency
Plastic foam cup
Metal cup (similar in size to plastic foam cup)
Hot water
Two Celsius thermometers
Graph paper

PREPARATION:

None

PROCEDURE:

1. Introduce activity by stating that scientists have a very special way of solving problems. We call it the scientific method. This activity demonstrates the use of the scientific method in solving a problem.
2. Distribute **Scientific Method** worksheets and display **Scientific Method** transparency to complete along with students.
3. Ask the students which keeps soup hot for a longer period of time—a plastic foam cup or a metal cup? (Most students will probably say the plastic foam cup.)
4. Inform students that the question was Step 1 and their answer is Step 2; this is a hypothesis. Fill in Steps 1 and 2 on the worksheets and transparency.
5. Ask them how they would test their hypothesis—Step 3? (Answer might include putting soup in both containers and taking a series of temperature readings to note the drop in temperature over the same period of time.)
6. Illustrate Step 3 by conducting an experiment:
   a. Set a plastic foam cup and a metal cup of similar size in front of the class.
   b. Pour an equal amount of hot water in each cup.
   c. Place a thermometer in each cup. After a minute, have students read the temperatures.
   d. Record temperatures on the chalkboard under the appropriate heading—**Plastic Foam Cup** or **Metal Cup**.
   e. Have students read the temperatures every four minutes for the next twenty minutes.
7. Draw conclusions—Step 4—by interpreting data.
   a. Results should be obvious.
   b. Liquid in metal cup cools faster.
8. Evaluate results—Step 5.
   a. For those who predicted the plastic cup would keep the soup hot longer, the experiment data confirms it, and the hypothesis can be accepted as theory.
   b. If the metal cup was predicted, the hypothesis is rejected.

9. Review graphing and have students graph the data for this experiment.
10. Check and compare results of graphing.

EXPECTED DATA:

Liquid in plastic foam cups stays hot longer.

EVALUATION:

Completed in Steps 3 to 10 of procedure.

TEACHER NOTES:

Students may need instruction in reading thermometers and in graphing procedures.

STATE GOALS:

BPS1-8-B1; BPS1-8-F5; BPS3-8-A2; BPS3-8-A1; BPS3-8-A5; BPS3-8-B3; BPS3-8-B1; BPS3-10-B3; BPS3-12-A,B; BPS4-8-D1; BPS4-8-C1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8-H1; BPS4-10-A1; BPS4-10-I1; BPS4-12-A,M; LA1-8,10,12-D1; LA1-8,10,12-G1; LA2-8,10,12-B2; LA2-8,10,12-D1; LA2-8,10,12-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-B1; LA3-8,10,12-E1; LA4-8-A1; LA4-8,10-C2; LA4-8-D2; LA4-8-D1; LA6-8,10-C2; LA6-10-C1; LA6-8-A1; M6-12-A1; M6-12-E2; M6-12-H1; SS5-8,10-A1; SS5-8,10-B1; SS5-8,10-B2.

Courtesy of *Life Science*, Addison-Wesley Publishing Company

FOCUSING ON SAFETY MEASURES

OBJECTIVES:

Recognize importance of safety in the classroom.
Develop a list of safety measures for the lab.
Relate and communicate with others.

MATERIALS:

One copy of **Safety Begins with Me** handout for each student

Small head of red cabbage	Ammonia
1000 mL beaker	Baking soda
100 mL graduated cylinder	Baking powder
Strainer	Antacid tablet
20 mL isopropyl alcohol	Aspirin tablet
Six test tubes in a test tube rack	Six droppers
White vinegar	Safety goggles

PREPARATION:

1. Shred red cabbage into a 1000 mL beaker.
2. Cover with 500 mL of water and boil for fifteen minutes until liquid becomes a dark purple color.
3. Strain liquid and add 20 mL of isopropyl alcohol to the liquid.
4. Place six test tubes in a test tube rack.
5. Half fill the test tubes with one solution each: diluted vinegar, diluted ammonia, baking soda solution, baking powder solution, antacid solution, and aspirin solution.

PROCEDURE:

1. Introduce activity by stating that working in this class gives you a chance to be involved in science rather than merely reading about it. When you are careful, the science classroom is a safe and rewarding place in which to learn.
2. Perform the following experiment for the students:
   a. Ask students to predict what will happen if ten drops of the red cabbage solution are added to the clear liquid in each test tube.
   b. Add the red cabbage juice to each test tube. Watch reactions.
3. Explain how important it is to be alert in the laboratory and to always expect the unexpected.
4. Emphasize that safety measures will protect you and others from injury. Remember, safety begins with you.
5. Divide class into small groups of four to six students.
6. Have the groups brainstorm to develop a list of safety practices for laboratory work. One student from each group will report to the class.
7. Compile a master list of safe laboratory practices on the chalkboard or transparency. Include all safety measures given in content outline (I C 3 a 1-11).
8. Distribute **Safety Begins with Me** handouts for students to use throughout course.

EXPECTED DATA:

Liquids will change colors; some will fizz or foam as they react.

EVALUATION:

Completed in Steps 2, 6, and 7 of procedure.

TEACHER NOTES:

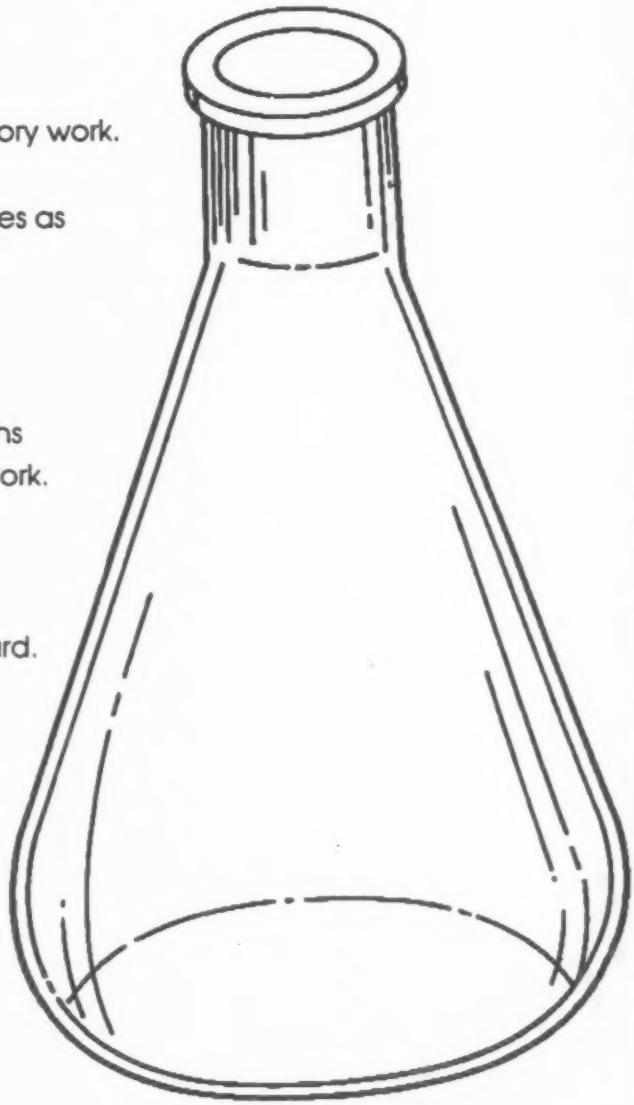
The drama of the experiment will provide interest for a seemingly dull topic. This would be an excellent opportunity to demonstrate safe use of equipment and correct procedures.

STATE GOALS:

BPS3-8-B4; LA1-8,10,12-A1; LA1-8,10,12-A3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA2-8,10-C3; LA2-12-C2; LA2-8,10,12-D1; LA2-8,10,12-D2; LA2-8,10-F3; LA2-8,10-F4; LA4-8-A1; LA4-8-D1; LA4-8-D2; LA6-8,10-C2; LA6-10-C1; PDH2-8-K3; PDH3-8, 10-A2; PDH3-8-G1; PDH3-8-G2; SS5-8-B2; SS5-8-J2; SS5-10-J3; SS5-12-C1.

Courtesy of *Focus on Life Science*, Merrill Publishing Company

SAFETY BEGINS WITH ME



Wash hands prior to all laboratory work.

Wear aprons and safety goggles as needed.

Restrain long, loose hair.

Read and understand directions before beginning laboratory work.

Keep fingers out of mouth.

Do all cutting on a cutting board.

Always use a metal trivet or insulating pad when heating beakers on the stove.

Remember: hot glass looks just like cold glass!

Turn off stove elements when finished.

Never heat an empty beaker; remove the beaker from the stove before its contents boil away.

Clean up all broken glass and report breakage to your teacher.

Courtesy of *Food Science and You*, Glencoe Publishing Company SA-31

DEVELOPING A METHOD OF REPORTING EXPERIMENTAL RESULTS

OBJECTIVES:

Interpret format for reporting experiment results.
Read and follow directions.

MATERIALS:

One copy of **Lab Report Form** for each student (located at beginning of **LIVING SCIENCE** Activities)
Lab Report Form transparency

PREPARATION:

None

PROCEDURE:

1. Introduce activity by explaining that laboratory experiments are a fun way to learn more about science and how it affects our daily life. In order to learn as much as possible, we need to adopt a systematic format for reporting our lab results. This is a copy of the format we will be using in this class.
2. Distribute **Lab Report Forms** and display corresponding transparency.
3. Explain that lab reports are usually kept in a notebook. There are several steps and parts to each report.
4. Point out the steps of the scientific method along the right side of the sheet and how it corresponds to what they will be doing when conducting and reporting the experiment.
5. Read the experiment worksheet prior to class and fill in top section.
   a. **Purpose**: State problem to be solved or question to be answered.
   b. **Hypothesis**: Predict a solution or make an educated guess based on known facts.
6. Explain that Step 3—**Test Hypothesis**—will be the actual class experiment.
   a. **Procedure**: Write a brief summary of what you do.
   b. **Observations**: Tell in brief descriptive statements what you actually observe happening. It may differ from what the instructions say should be happening.
   c. **Data**: Gather information during experiment and arrange in a table or chart. Each experiment will suggest a format for a sample data table.
7. Tell students that following the experiment, they will **Draw Conclusions**—Step 4.
   a. **Calculations**: Include the solutions to any mathematical questions asked in the instructions.
   b. **Questions**: Answer the questions included at the end of each experiment. Attach to lab form if additional space is needed.
8. Finalize lab report with Step 5—**Evaluate Results**.
   a. **Conclusion**: Write a brief statement as to whether you accept or reject your hypothesis based on the results of your experiment.
   b. Attach all materials pertaining to the experiment to the **Lab Report Form** before turning in to the instructor.

EXPECTED DATA:

None

EVALUATION:

Completed as students use form for actual experiments.

TEACHER NOTES:

Enhance activity by displaying a completed **Lab Report Form** for an upcoming experiment. Students could make notes in order to have their own sample for future use.

STATE GOALS:

BPS3-8-B2; BPS3-8-B3; BPS3-8-B6; BPS3-12-A.B; BPS4-8-F1; BPS4-8-G1; LA1-8, 10,12-D1; LA1-8,10,12-D2; LA2-10,12-B1; LA2-8,10,12-B2; LA2-8,10,12-D1; LA2-8, 10-D2; LA2-8,10,12-F1; LA2-8,10-F3; LA2-8,10-F4; LA2-10-B3; LA3-8,10-B1; LA3-8, 10-C1; LA3-12-D1; M6-12-E2.

BECOMING FAMILIAR WITH LABORATORY EQUIPMENT: THE METRIC SYSTEM

OBJECTIVES:

Review metric system and the use of prefixes.
Identify scientific equipment used for measuring in the laboratory.
Organize and manage human and material resources.

MATERIALS:

One copy of **Metrics Made Simple** handout for each student
Metrics Made Simple transparency
One meter stick per lab group
Triple beam balance
Graduated cylinder
Beaker
Erlenmeyer flask
Celsius thermometer
Stick of gum, cookie sheet, and slice of cheese per lab group

PREPARATION:

1. Assemble lab equipment display.
2. Gather items to be measured for each lab group.

PROCEDURE:

1. Introduce this activity by showing familiar items and pointing out their metric measurements (the mass of a bag of potato chips, volume of a drink bottle, size of film of a 35mm camera). Explain that scientists record their observations in the form of measurements. It is important to have standardized measurements, so the metric system and specialized equipment are used to provide accurate results.
2. Distribute **Metrics Made Simple** handout and display corresponding transparency.
3. Explain terms **length, weight** versus **mass, volume**, and **temperature.** Weight of an object on Earth is different from its weight on the moon, though the mass of the object is the same in both places.
4. Use the dollar-bill-divided-into-cents illustration to explain the use of prefixes in metrics. Emphasize the more commonly used prefixes.
5. Display different pieces of lab equipment: meter stick, balance, graduated cylinder, beaker, Erlenmeyer flask, Celsius thermometer. Have students do the following:
   a. Identify the quantity measured (length, weight/mass, volume, temperature).
   b. Give the unit of metric measurement (meter, gram, liter, or other).
   c. Restate each measurement using a different prefix.
6. Divide class into lab groups of two students each.
7. Distribute meter sticks and have students read and record measurements of the following items:
   a. stick of gum
   b. cookie sheet
   c. table top
   d. slice of cheese
   e. height of doorknob
8. Have students share results with class. Determine accuracy.

EXPECTED DATA:

Measurements will vary.

EVALUATION:

Completed in Steps 7 and 8 of procedure.

TEACHER NOTES:

Activity could be expanded by expressing the measurements differently through the use of prefixes. Students could also bring and display food and clothing labels that show metric measurements.

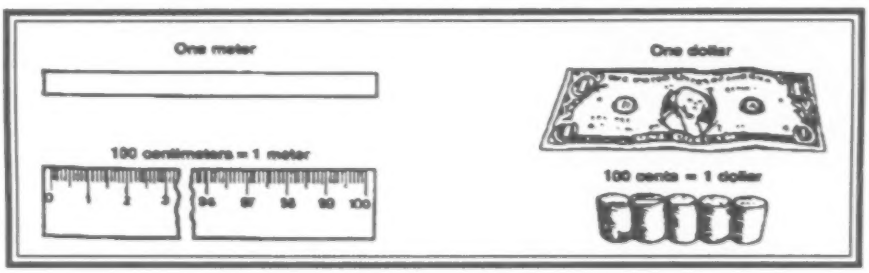
STATE GOALS:

BPS3-8-A1; BPS3-8-B1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8-B3; BPS3-8-B5; BPS3-8-B6; BPS3-10-B3; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-B1; BPS4-8,10-E1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-8-L1; BPS4-8-M1; BPS4-8,10-F1; BPS4-12-A.M; LA1-8,10,12-D1; LA1-8,10,12-D2; LA2-8-B2; LA2-10-B3; LA2-8,10,12-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10,12-B1; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8,10-C2; LA4-8-D1; LA4-8-D2; LA4-12-E2; LA6-8-A1; LA6-8,10-C2; LA6-10-C1; M3-8-D2; M3-8-D3; M3-10-D2; M3-10-E1; M3-12-A1; M3-12-E1; M5-12-A1; M5-12-E2; M7-8-D1; M7-8,10,12-E1; M7-8,10-E4; M7-8,10-E5; M7-8,10-E6; M7-8,10,12-G1; M7-8,10-G2.

METRICS MADE SIMPLE

Measuring with metrics need not be hard or complicated. Study the information given below and you should be able to measure the metric way.

When We Measure	We Use The Unit Name	We Use The Symbol	It Tells Us
length	meter	m	How long?
weight/mass	gram	g	How heavy?
volume	liter	L or l	How full?
temperature	Celsius	C	How hot or cold?



Remember all prefixes mean the same no matter what you are measuring. When we add the prefixes to the unit names, we get the following units of metric measure.

Prefixes Used In Metrics

kilo	=	1000
hecto	=	100
deka	=	10
unit of 1		
deci	=	.1
centi	=	.01
milli	=	.001

length	1 kilometer = 1000 meters 1 centimeter = 0.01 meter 1 millimeter = 0.001 meter
weight/mass	1 kilogram = 1000 grams 1 centigram = 0.01 gram 1 milligram = 0.001 gram
volume	1 kiloliter = 1000 liters 1 centiliter = 0.01 liter 1 milliliter = 0.001 liter

Courtesy of *Biology: An Everyday Experience*, Merrill Publishing Company SA-37

BECOMING FAMILIAR WITH LABORATORY EQUIPMENT: THE GRADUATED CYLINDER

OBJECTIVES:

Measure liquids using a graduated cylinder.
Read the volume of liquids by using the meniscus.
Demonstrate responsibility for carrying out activity.

MATERIALS:

One copy of **Using a Graduated Cylinder** experiment worksheet for each student
2 L drinking bottle
100 mL graduated cylinder
100 mL beaker
Water

PREPARATION:

None

PROCEDURE:

1. Introduce activity by displaying a 2 L drinking bottle and asking students how much volume it holds. Explain that we use the metric system to determine the volume or how much space a substance occupies. To measure volume in the science lab, we must use specialized equipment. This experiment will teach you how to measure the volume of liquids by using a graduated cylinder.
2. Demonstrate how to read the volume of a liquid in a narrow container using the bottom of the curve, or meniscus, formed by the liquid.
3. Stress that for greatest accuracy the cylinder should be placed on a level surface and be read at eye level.
4. Divide class into lab groups of two students each.
5. Distribute worksheets and review directions.
6. Upon completion, discuss results and questions. Provide correct answers.

EXPECTED DATA:

Beaker Reading	Graduated Cylinder Reading
20 mL	18 mL
30 mL	26 mL
25 mL	23 mL

1. Not very precise
2. Graduated cylinder
3. Each cylinder is calibrated individually, while the same care is not taken in putting the lines on beakers.

EVALUATION:

Completed in Step 6 of procedure.

TEACHER NOTES:

Correlate how reading of the meniscus is the same whether using a graduated cylinder in the science lab or a glass measuring cup in the food-preparation area.

STATE GOALS:

BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8-B1; BPS3-8,10-B3; BPS3-8,10-B4; BPS3-8-B5; BPS3-8-B6; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-B1; BPS4-8-D1; BPS4-8,10-E1; BPS4-8-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-8-L1; BPS4-8,10-M1; BPS4-12-A.M; LA1-8,10,12-A3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA1-8,10,12-B2; LA2-10-B3; LA2-8-C2; LA2-8,10-C3; LA2-8,10-D1; LA2-8-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8,10-C2; LA4-8-D1; LA4-8-D2; LA6-8-A1; LA6-8,10-C2; LA6-10-C1; M3-8,10-D2; M3-8-D3; M3-12-A1; M3-12-E1.

USING A GRADUATED CYLINDER

Experiment

Volume is the amount of space material occupies. It can be determined in a number of ways. For objects such as a cube or a rectangular solid, you measure the length, width, and height and multiply these values to find the volume. Liquids are even easier to work with. You simply pour the liquid into a container that has volume measurements marked on it and read the level of the liquid. It is important to read the volume from the meniscus, or the bottom of the curve the liquid forms, and to estimate the volume to one-tenth of the smallest division on the scale.

Materials:

100 mL beaker
100 mL graduated cylinder
Water

Prodedure:

1. Fill your 100 mL beaker with water to the 20 mL line.
2. Pour this water into a 100 ml graduated cylinder. Read and record the volume of the water in your data table.
3. Repeat Step 2 with 30 mL water.
4. Repeat Step 2 with 25 mL water. You will need to estimate the amount you think will be 25 mL.

Sample Data Table

Beaker Reading	Graduated Cylinder Reading
20 mL	
30 mL	
25 mL	

Questions:

1. How precise were the volume readings in the beaker?

2. Which piece of equipment is claibrated more precisely? The beaker or the graduated cylinder?

3. Why do you suppose graduated cylinders cost three times as much as beakers of similar volume?

SA-41

BECOME FAMILIAR WITH LABORATORY EQUIPMENT: THE TRIPLE BEAM BALANCE

OBJECTIVES:

Measure mass using a laboratory balance.
Demonstrate responsibility for carrying out an activity.

MATERIALS:

One copy of **Using a Triple Beam Balance** worksheet for each student
Triple beam balance per lab station
Three items to be massed on each balance (paper clips, scissors, beakers, cooking utensils)
Weighing paper or waxed paper

PREPARATION:

Select items to be massed:

1. one with a mass of less than 10 grams
2. one with a mass between 10 and 100 grams
3. one with a mass greater than 100 grams

PROCEDURE:

1. Introduce activity by explaining the need for very accurate measurements when doing scientific experiments. Today's activity is designed to teach you how to use a laboratory balance, the instrument you will use to mass materials.
2. Demonstrate the use of the triple beam balance. Mass an object, a sample of sugar or salt on weighing paper, and a liquid. Explain the different techniques for each item. Instruct students how to read the scales.
3. Divide class into lab groups according to number of triple beam balances available.
4. Distribute experiment worksheets and review directions.
5. Emphasize that solid chemicals must be massed on previously massed weighing paper or waxed paper; liquids must be massed in a previously massed container.
6. Point out that chemicals must never be placed directly on the balance pan.
7. Remind students that if the balance does not zero properly to call you rather than attempt to adjust it themselves.
8. Circulate throughout the lab as students practice massing objects.
9. Compare recorded information and discuss questions.

EXPECTED DATA:

Results will vary, depending on the items massed.

1. 1 g—The mass of a penny is approximately 3.2 g.
2. Mass an empty 10 mL graduated cylinder. Add exactly 10 mL water and mass again. The mass of the water is the difference in mass between the two readings.

EVALUATION:

Completed in Steps 8 and 9 of procedure.

TEACHER NOTES:

Expand experiment by having students mass materials requiring weighing papers and liquids requiring containers.

STATE GOALS:

BPS1-8-B1; BPS1-8-C3; BPS1-8-F3; BPS1-10-F5; BPS1-12-C1; BPS3-8,10-A1; BPS3-8-A5; BPS3-8,10-A2; BPS3-8,10-B3; BPS3-8-B4; BPS3-8-B6; BPS3-10-B2; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-B1; BPS4-8,10-C1; BPS4-8,10-D1; BPS4-8,10-E1; BPS4-12-A.M; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-L1; BPS4-8,10-M1; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10, 12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-G1; LA2-8,10,12-B2; LA2-8, 10,12-D2; LA2-8,10,12-F1; LA2-8,10-F4; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8, 10-A3; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8-D1; LA4-8-D2; M3-8-D3; M3-12-E1; M3-12-A1; M6-12-A1; M6-12-E1; M6-12-E2.

Courtesy of *Food Science and You*, Glencoe Publishing Company

USING A TRIPLE BEAM BALANCE

Experiment

There are many opportunities to mass substances in science. Therefore, one of the first skills you need to learn is how to use a balance, the instrument you will use to mass materials. This experiment is designed to teach you to use a laboratory balance.

At each laboratory station you will find either a low-form or a high-form triple beam balance. Either form is simply called a balance. If the balance does not zero properly, ask your teacher to correct the problem.

Prodedure:

1. From your teacher, obtain three objects to be massed.
2. Place one object on the balance pan with all the riders set on zero. This will cause the pointer to point to the top of the scale.
3. Move the 100 g rider out to the first notch on its beam. If the pointer drops all the way to the bottom of the scale, 100 g is too much. You would then return this rider to zero. If the pointer does not drop, move the rider to the 200 g mark. Again, if this is too heavy, move it back to 100 g.
4. Next move the 10 g rider along its beam, one notch at a time, until the pointer drops to the bottom of the scale. When this happens, move the rider back to the previous notch.
5. Now slide the 1 g rider along its arm until the pointer settles exactly at zero.
6. You are ready to read the balance. The mass of the object on the balance is the sum of the values of the three riders. Assume the riders on your balance are arranged as follows—the first is on the 100 g notch, the second is on the 60 g notch, and the last is at what you estimate to be 2.65 g (meaning it is halfway between 2.6 and 2.7). The mass of the object is 162.65 grams.
7. In a data table similar to the sample data table shown, record the name of the object and its mass.
8. Mass each of the other objects and record the information in your data table.

Questions:

1. Would a penny have a mass closer to 1 g, 10g, or 100g?
2. If you had to determine the mass of 10 mL of water how would you do it?

Sample Data Table

Object	Mass

SA-45

REPRESENTING ELEMENTS BY ABBREVIATIONS CALLED SYMBOLS

OBJECTIVES:

Recognize elements by symbol abbreviations.
Identify where to locate and how to use information.

MATERIALS:

Large monthly calendar
Periodic Table transparency or poster (located at beginning of **LIVING SCIENCE** Activities)
One copy of **Name the Element** worksheet for each student

PREPARATION:

None

PROCEDURE:

1. Introduce the activity by asking what these abbreviations represent: IL, CA, IN, NY, TX? Explain that just as names of states can be represented by letter symbols, so can elements. Give some common examples of elements and the letter symbols.
2. Demonstrate how an element symbol is written.
3. Hold up a large calendar showing any single month. Point out that the calendar has a special way of showing several things on one chart. Ask the following questions:
   a. What does each box on the calendar represent? (one day)
   b. What does each horizontal row represent? (one week)
   c. What does each vertical column represent? (same day of week)
4. Display **Periodic Table** transparency or poster (located at beginning of **LIVING SCIENCE** Activities).
5. Point out similarity of arrangement with a calendar month.
   a. Each box represents a chemical element.
   b. Elements are arranged across the rows in increasing atomic number.
   c. Families of elements—elements with similar characteristics—are arranged in vertical columns.
      1) metals
      2) nonmetals
6. Name a variety of common and well-known elements: gold, silver, hydrogen, oxygen, calcium, carbon, nitrogen, helium. Ask students to point them out on the periodic table.
7. Distribute **Name the Element** worksheet and review directions. Have students complete worksheet.
8. Discuss correct answers with students.

EXPECTED DATA:

1. O	6. S	11. K	16. fluorine
2. Fe	7. P	12. Hg	17. iodine
3. Cl	8. H	13. He	18. calcium
4. C	9. N	14. Al	19. magnesium
5. Na	10. Zn	15. Cu	20. lead

EVALUATION:

Completed in Steps 5 and 6 of procedure.

TEACHER NOTES:

Have **Periodic Table** available and on display throughout the course. Advanced students may research the discovery and name of a particular element.

STATE GOALS:

BPS1-8-B1; BPS1-8-B2; BPS1-12-C1; BPS1-10-A3; LA1-8,10,12-A1; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-G1; LA1-8,10,12-E2; LA2-10-B1; LA2-8,10-B2; LA2-8,10-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10,12-F3; LA2-8,10,12-F4; LA2-10-B3; LA3-8,10,12-B1; LA4-8-A1; LA4-8-D1; LA4-8-D2; LA6-8-A1; LA6-8,10-C2; LA6-10-C1.

Courtesy of *Focus on Life Science*, Merrill Publishing Company and *Life Science*, Addison-Wesley Publishing Company

NAME THE ELEMENT

Worksheet

Directions: Match each element in the left column with the correct symbol from the right column. Write the symbol in the space provided. Do not use any symbol more than once. Some symbols will not be used.

	ELEMENT	SYMBOL
____	1. oxygen	Al
____	2. iron	Zn
____	3. chlorine	C
____	4. carbon	Cl
____	5. sodium	Fe
____	6. sulfur	H
____	7. phosphorus	K
____	8. hydrogen	N
____	9. nitrogen	Na
____	10. zinc	O
		P
		S

Directions: In the blanks, write the symbols for the elements listed in 11 through 15 and the names of the elements whose symbols are listed in 16 through 20.

11. potassium _____
12. mercury _____
13. helium _____
14. aluminum _____
15. copper _____

16. F _____
17. I _____
18. Ca _____
19. Mg _____
20. Pb _____

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COMBINING CHEMICAL SYMBOLS TO FORM CHEMICAL FORMULAS

OBJECTIVES:

Interpret chemical formulas.
Read and follow directions.

MATERIALS:

One copy of **Chemical Formulas** worksheet for each student

PREPARATION:

None

PROCEDURE:

1. Introduce activity by writing CO_2 on chalkboard or transparency. Explain the use of the symbols, formulas, and subscripts. Write the number of atoms of each element for the CO_2 formula. Point out that the absence of a subscript means only one atom of the element is present in the molecule.
2. Distribute worksheet and review directions.
3. Discuss responses and provide correct answers.

EXPECTED DATA:

1. 2
2. 2
3. 3
4. 1
5. 3
6. 2 hydrogen, 2 oxygen, 4 atoms
7. 0 hydrogen, 3 oxygen, 1 carbon, 5 atoms
8. 3 hydrogen, 2 oxygen, 2 carbon, 8 atoms
9. 8 hydrogen, 1 oxygen, 3 carbon, 12 atoms
10. 22 hydrogen, 11 oxygen, 12 carbon, 45 atoms
11. the elements in a compound and the number of each element
12. how many atoms of each element are in a molecule

EVALUATION:

Completed in Step 3 of procedure.

TEACHER NOTES:

Use of physical models representing atoms and molecules may help students visualize formation of chemical formulas. Ask students to bring in labels from foods and cleaning products that list chemical ingredients. Using resource books, find the formula of each ingredient.

STATE GOALS:

BPS1-8-B1; BPS1-10-D1; BPS4-8-B1; LA1-8,10,12-A1; LA1-8,10,12-B3; LA1-8,10, 12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8, 10-B2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10-B3; LA2-10-C3; LA2-12-C2; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; M4-12-D1.

Courtesy of *Focus on Life Science*, Merrill Publishing Company

CHEMICAL FORMULAS

Worksheet

Directions: In the blanks, write the number of elements contained in each of the following formulas.

1. $NaCl$ _____
2. H_2O _____
3. H_2SO_4 _____
4. H_2 _____
5. $C_6H_{12}O_6$ _____

Directions: Write the information requested in the chart below.

Formula	Number of Hydrogen Atoms	Number of Oxygen Atoms	Number of Carbon Atoms	Total Number of Atoms
6. H_2O_2				
7. $CaCO_3$				
8. $NaC_2H_3O_2$				
9. C_3H_7OH				
10. $C_{12}H_2O_{11}$				

Directions: Answer the questions.

11. What information is in a formula? _____

_____

_____

12. What does a subscript tell? _____

_____

_____

WRITING A DESCRIPTION OF A CHEMICAL REACTION BY THE USE OF EQUATIONS

OBJECTIVES:

Interpret a simple chemical equation.
Explain the reason and be able to balance equations.
Read and follow directions.

MATERIALS:

Eighteen plastic foam balls per six to eight students
Black and blue latex paint
One copy of **Balance the Equation** worksheet for each student

PREPARATION:

For each set of eighteen balls do the following:

1. Paint four black for carbon (C), four blue for hydrogen (H), and leave ten white for oxygen (O).
2. Use pipe cleaners or toothpicks to build two C_2H_2 and five O_2 molecules.

PROCEDURE:

1. Introduce activity by explaining that a chemical equation describes what happens in a chemical change.
2. Write the equation $2\ H_2 + O_2 \rightarrow 2\ H_2O$ on the chalkboard or transparency and explain the steps in writing a balanced chemical equation.
   a. Use correct symbols and formulas for the substances in the reaction.
   b. Put the reactants on the left side of the arrow; the products on the right.
   c. Check the number of atoms on each side to see if the equation is balanced.
   d. Use coefficients to balance the equation if the number of atoms is not in balance.
3. Divide class into groups of six to eight students each and distribute sets of foam ball molecule models.
4. Write the equation $2\ C_2H_2 + 5\ O_2 \rightarrow __CO_2 + __H_2O$ on the chalkboard or transparency.
5. Identify the molecules as acetylene gas and carbon dioxide. Explain color coding of plastic balls.
6. Ask students to rearrange the atoms, using all of them, to form CO_2 and H_2O molecules.
7. Compare results among groups.
8. Distribute **Balance the Equation** worksheet and review directions.
9. Discuss students' responses and provide correct answers.

EXPECTED DATA:

1. $\underline{2}\ Na + __\ Cl_2 \rightarrow \underline{2}\ NaCl$
2. $\underline{2}\ Mg + __\ O_2 \rightarrow \underline{2}\ MgO$
3. $\underline{3}\ H_2 + __\ N_2 \rightarrow \underline{2}\ NH_3$
4. $__\ Mg + 2\ HCl \rightarrow __\ MgCl_2 + __\ H_2$
5. $\underline{2}\ H_2O_2 \rightarrow 2\ H_2O + __\ O_2$

6. $__ C_6H_{12}O_6 + \underline{6}\ O_2 \rightarrow \underline{6}\ CO_2 + \underline{6}\ H_2O$
7. $__ WO_3 + \underline{3}\ H_2 \rightarrow __ W + \underline{3}\ H_2O$

8. Chemical equations are shorter. The substances and their quantities are more clearly expressed.
9. Atoms are never lost or gained in a chemical change.

Brainteaser: 3/three molecules

EVALUATION:

Completed in Step 4 of procedure.

TEACHER NOTES:

Students will quickly produce 4/four CO_2 and 2/two H_2O molecules from the models. Without a detailed presentation on your part, students have balanced the equation and have understood why it is necessary to have the same number and kind of atom on both sides of the equation.

STATE GOALS:

BPS1-8-B1; BPS1-10-D1; BPS4-8-B1; LA1-8,10,12-A1; M4-8-B2; M4-12-B1; M4-12-D1; M7-8,10,12-E1; M7-8,10-E4; M7-8,10-E5; M7-8,10,12-G1; M7-8,10-G2; LA1-8,10,12-A1; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8,10-B2; LA2-8-D1; LA2-8-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10-B3; LA2-10-C3; LA2-12-C2.

 Courtesy of *Chemistry: A Modern Course* and *Focus on Life Science*, Merrill Publishing Company

BALANCE THE EQUATION

Worksheet

Directions: Write coefficients in the blanks to balance the equations. If the coefficient is 1, do not write it.

1. ___ Na + ___ Cl_2 → ___ NaCl
2. ___ Mg + ___ O_2 → ___ MgO
3. ___ H_2 + ___ N_2 → ___ NH_3
4. ___ Mg + ___ HCl → ___ $MgCl_2$ + ___ H_2
5. ___ H_2O_2 → ___ H_2O + ___ O_2
6. ___ $C_6H_{12}O_6$ + ___ O_2 → ___ CO_2 + ___ H_2O
7. ___ WO_3 + ___ H_2 → ___ W + ___ H_2O

Directions: Answer the questions.

8. Why are word equations not used for chemical reactions?

_____

_____

_____

9. Why is it important to use coefficients in chemical equations?

_____

_____

_____

Brainteaser:

How many molecules of water are represented in the following equation?

$C_2H_5OH + 3O_2$ → ___ H_2O + ___ CO_2

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DIFFERENTIATING BETWEEN PHYSICAL AND CHEMICAL CHANGES

OBJECTIVES:

Distinguish between physical and chemical changes.
Demonstrate responsibility for carrying out activity.
Read and follow directions.

MATERIALS:

One copy of **Physical and Chemical Changes** experiment worksheet for each student
One copy of **Physical or Chemical Change? You Decide!** worksheet for each student

Two wood splints	Metal diffuser
Matches	Sodium chloride
Forceps	Sodium bicarbonate
Ice cubes	120 mL white vinegar
250 mL beaker	Water

Per Lab Group:

Triple beam balance	100 mL beaker
Magnifying glass	Watch glass
100 mL graduated cylinder	Metal diffuser

PREPARATION:

1. Assemble materials for two demonstrations.
2. Set up supply table with materials for student experiment.

PROCEDURE

1. Introduce activity by explaining that the following demonstration will illustrate the difference between physical and chemical changes.
   a. Have students examine wood splints.
   b. Break one splint into two or four small pieces.
   c. Have students re-examine the pieces. Ask what they observed? Is the wood different in composition?
   d. Continue demonstration by burning one of the wood pieces.
   e. Have students examine the burned product. Ask how the product is different from the original? Which demonstration represents a physical change to the wood? A chemical change?
2. Emphasize differences and similarities between physical and chemical changes using information from the content outline (11 A 7 a, b).
   a. Demonstrate phase changes.
      1) Heat ice (solid) in a beaker until it changes to water (liquid).
      2) Heat the water until steam (gas) escapes.
   b. Ask students to name and describe each state of matter as they observe it.
   c. Point out that these are physical changes.
3. Divide class into lab groups of two students each.
4. Distribute **Physical and Chemical Changes** experiment worksheet.
   a. Review how to mass using the triple beam balance.
   b. Demonstrate how to heat a watch glass.

5. Allow students to perform experiment offering assistance as needed.
   a. Use only 1 to 2 mL of each solution to evaporate. More liquid will only lengthen the time required for the experiment.
   b. Warn students not to lean over the watch glass as the liquid evaporates.
      1) Spattering may occur as solid begins to crystallize.
      2) Heating the solution slowly will minimize spattering.
   c. Explain that due to the rapid rate of crystallization, few observable cubic crystals of sodium chloride form.
   d. Leave one watch glass and NaCl liquid in a safe place so the water can evaporate slowly.
   e. Observe crystals formed similar to those at the beginning of experiment.
6. Distribute **Physical or Chemical Change? You Decide!** worksheets.
7. Discuss experiment results and worksheet questions.

EXPECTED DATA:

Experiment:

Samples	Original	After Evaporation
Sodium chloride		
Appearance	cubic crystals	nonuniform crystals
Taste	salty	salty
Sodium bicarbonate		
Appearance	white powder	not quite as powdery
Behavior with vinegar	produces gas(CO_2)	no gas produced

1. Bubbles of gas were given off when the baking soda dissolved.
2. Yes, the solid had the same taste as the original solid known to be sodium chloride. Some of the crystals had the same shape as the original, although these were hard to see without a microscope. A physical change.
3. No, because it did not produce bubbles when vinegar was added to it like the baking soda did. A chemical change.

Worksheet:

1. c	6. c	11. p
2. c	7. p	12. c
3. p	8. p	13. p
4. c	9. c	14. c
5. p	10. c	15. p

16. Both physical and chemical changes involve changes in matter. During chemical changes, substances become new and different substances, while during physical changes, the basic chemical nature of the substance is not changed. Examples will vary.
17. Depends. For example, shredding cheese and gently heating it causes no measurable loss of nutritional value in the cheese. But shredding potatoes before boiling them will cause many nutrients to dissolve in the water during cooking.

EVALUATION:

Completed in Step 7 of procedure.

TEACHER NOTES:

Point out the combination of physical and chemical changes of food during digestion. Chewing, grinding, and mixing of food causes a physical change. Enzymes in the saliva and stomach and intestine juices chemically change the food into a usable form for the body cells.

STATE GOALS:

BPS1-8-F3; BPS1-8,10-F5; BPS1-8-D2; BPS1-8-L1; BPS1-8-L2; BPS1-8-P4; BPS1-12-C1; BPS1-12-C1; BPS1-12-D3; BPS1-12-F2; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-B1; BPS3-8-B3; BPS3-8-B5; BPS3-10-B3; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8-B1; BPS4-8,10-C1; BPS4-8-D1; BPS4-8,10-E1; BPS4-8,10-G1; BPS4-8,10-H1.

PHYSICAL AND CHEMICAL CHANGES

Experiment

In this experiment, you will carry out two kinds of changes by dissolving substances. One change is a physical change, since the original substance can be easily reclaimed. The other is a chemical change, since the original substance is destroyed when it is dissolved.

Materials:

Magnifying glass
Triple beam balance
100 mL beaker
Water
Metal diffuser
Sodium chloride (table salt)
Sodium bicarbonate (baking soda)
100 mL graduated cylinder
Watch glass
White vinegar

Procedure:

1. Obtain materials needed from supply table.
2. Use a magnifying glass to observe crystals of sodium chloride (table salt). Describe or draw their appearance in the data table.
3. Taste a few crystals and describe the taste in your data table.
4. Repeat Step 2 with sodium bicarbonate (baking soda).
5. Mass 1 g sodium chloride and dissolve in 20 mL water in a 100 mL beaker. Stir the mixture until the solid has completely dissolved. Observe the mixture during the dissolving process.
6. Place a small amount of the mixture on a watch glass. Carefully heat the watch glass on the stove over medium heat until the liquid just boils away. Remove the watch glass from the heat and allow to cool.
7. With the magnifying glass, observe the solid remaining on the watch glass. Taste a few of the crystals. In your data table, describe their appearance and taste.
8. Repeat Steps 5 and 6 with 1 g sodium bicarbonate, but use 20 mL vinegar instead of water. In your data table, note the behavior of the mixture during the dissolving process.
9. With the magnifying glass, observe the solid remaining on the watch glass and describe it in your data table. Do not taste this sample.
10. To the solid remaining in Step 9, add a small amount of vinegar. In your data table, describe the behavior of the mixture as the solid dissolves.

Questions:

1. How did dissolving the sodium chloride differ from dissolving the sodium bicar bonate?
2. After the water evaporated, was the substance remaining sodium chloride? How do you know? What kind of change was this?
3. After the vinegar evaporated, was the substance remaining sodium bicarbonate? How do you know? What kind of change was this?

Sample Data Table:

Samples	Original	After Evaporation
Sodium chloride		
Appearance		
Taste		
Sodium bicarbonate		
Appearance		
Behavior		

PHYSICAL OR CHEMICAL CHANGE? YOU DECIDE!

Worksheet

Directions: For number 1 thru 15 determine whether each action is a physical or chemical change. Mark with a **P** for a physical change and a **C** for a chemical change. Answer 16 and 17 as completely as possible.

___ 1. burning a match

___ 2. frying pancakes

___ 3. folding paper

___ 4. baking a cake

___ 5. breaking chalk

___ 6. digesting food in stomach

___ 7. chewing food

___ 8. peeling potato

___ 9. burning gasoline in an engine

___ 10. using glucose in a cell

___ 11. melting ice

___ 12. burning paper

___ 13. shredding cheese

___ 14. browning of an apple slice

___ 15. slicing bread

16. Explain the similarities and differences in physical and chemical changes. Give an example of each (must be different from numbers 1 thru 15 above.)

_____

_____

_____

17. Will a physical or chemical change affect the nutritional value of the food? Explain and give examples.

_____

_____

_____

RECOGNIZING THE NAMES AND SYMBOLS OF THE ELEMENTS USED IN FOOD AND TEXTILE SCIENCE

OBJECTIVES:

Identify elements by their symbols.
Follow directions.

MATERIALS:

One copy of **Elements Bingo** card to be made in class for each student
Markers such as paper squares, beans, paper clips

PREPARATION:

1. Prepare bingo cards with a variety of combinations of the element symbols.
   a. Draw four rows of four columns each for a total of sixteen spaces per card.
   b. Write a symbol in each square. The following are suggested elements:

H	hydrogen	FE	iron	Cl	chlorine
O	oxygen	Na	sodium	Al	aluminum
N	nitrogen	Ca	calcium	Pb	lead
C	carbon	Hg	mercury	I	iodine
Se	selenium	S	sulfur	P	phosphorus
Zn	zinc	F	fluorine	Cu	copper
Ma	manganese	K	potassium	Mg	magnesium

PROCEDURE:

1. Distribute **Elements Bingo** cards and markers.
2. Conduct game by reading the name of the element and having students locate the appropriate symbol on the bingo card.
3. Determine winner as first person to cover a horizontal, vertical, or diagonal row of symbols.

EXPECTED DATA:

None

EVALUATION:

Completed in Step 2 of procedure.

TEACHER NOTES:

Small prizes or privileges may be awarded to card winners. Further the activity by handing out a list of several chemical formulas for food and textiles. Have students identify the elements found in each formula.

STATE GOALS:

BPS4-8-B1; LA2-8,10-B2; LA2-8-D1; LA2-8-D2; LA2-8,10,12-F1; LA2-8,10-F3; LA2-8,10-F4.

ANALYZING PRODUCTS THROUGH SENSORY EVALUATION

OBJECTIVES:

Identify senses used for product recognition.
Distinguish interdependency of the senses.
Read and follow directions.
Relate to and communicate with others.

MATERIALS:

One copy of **More than Meets the Eye** worksheet for each student

PREPARATION:

None

PROCEDURE:

1. Introduce subject by explaining that sometimes it's difficult to identify products by their appearance. A combination of the senses of seeing, smelling, tasting, touching, and hearing are used to identify a product.
2. Distribute and review worksheet directions. Mentally picture the product and check the senses used to identify the product.
3. Students share responses to the following questions:
   a. How many products are recognized by sight?
   b. Which products cannot be identified by sight? Why?
   c. Which products should not be identified by taste? Why?
   d. How many products use more than one sense for identification? Do any use all five?
   e. What does this activity tell you about the interaction of the senses?

EXPECTED DATA:

Responses will vary. Liquids are neither recognized by sight nor should they be identified by taste. Crunchy food products, the watch, and the video game are also the only products identified by sound.

EVALUATION:

Completed in Step 3 of procedure.

TEACHER NOTES:

The list of products can be varied to meet class time allotment and/or students' familiarity with products. Emphasize how sensory evaluation is used in jobs/careers.

STATE GOALS:

BPS1-8-P3; BPS1-12-M3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8,10-B3; BPS3-8-B1; BPS3-8-B4; BPS3-8-B6; BPS3-12-A.B; BPS4-8,10-C1; BPS4-8,10-D1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-8,10-M1; BPS4-12-A.M; LA1-8,10,12-A2; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-G1; LA2-8-B2; LA2-8-D1; LA2-8-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-B1; LA3-8,10,12-C1; LA4-8-A1; LA4-8-C2; LA4-8-D1; LA4-8-D2; LA6-8-A1; LA6-8,10-C2; LA6-8-C1; M6-12-A1.

MORE THAN MEETS THE EYE

Worksheet

Directions: Many senses are used to identify a product. In the space below, check the sense/s used to identify the product.

ITEM	SIGHT	SMELL	TASTE	TOUCH	HEARING
jello					
sweater					
cracker					
bleach					
mouthwash					
raisins					
video game					
peanuts					
cologne					
watch					
Rice Krispies					
wet towelettes					
orange					
brick					
French fries					

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TESTING PRODUCTS SCIENTIFICALLY USING THE HUMAN SENSES

OBJECTIVES:

Discover difficulty in identifying common substances by odor alone.
Recognize the interdependency of the senses.
Read the following directions.
Relate to and communicate with others.

MATERIALS:

One copy of **Odor Recognition** experiment worksheet for each student

Forty-five test tubes
Peppermint extract
Three test tube racks
Cedar chips
Aluminum foil
Cocoa
Cloves
Onion
Fabric softener
Cinnamon
Instant coffee
Paint thinner
Tea leaves
Chili powder
Bleach
Vanilla extract
Sauerkraut
Lemon juice
Blindfold for each lab group

PREPARATION:

1. Prepare a set of test tube samples in test tube racks for every eight students.
2. Wrap the test tubes in aluminum foil to eliminate the sense of sight.
3. Place about 1 mL of each substance in a test tube. Label each test tube with a three-digit code number. (Gum labels work well.) NOTE: Seal test tubes with aluminum foil. Store in the refrigerator if prepared more than one day in advance. Remove test tubes from the refrigerator two hours prior to the experiment so the substances can warm enough to produce a sufficient odor to be detected.
4. Record code numbers and identity of substance to share later with students.

PROCEDURE:

1. Introduce experiment by stating when one sense is isolated, identification of well known samples can be difficult. This experiment will test the ability to identify common substances by odor alone.
2. Form lab partners and distribute experiment worksheets and blindfolds.
3. Review experiment procedure explaining that eight students (four lab groups) will share a test tube rack of samples.
4. Emphasize importance of the partner who is not wearing the blindfold, not looking into the test tubes for an unfair advantage.
5. Stress silence to avoid influencing others. Keep conditions as uniform as possible.
6. Reveal identity of substances upon completion of experiment.

EXPECTED DATA:

Code	Actual Identity	Code	Actual Identity
693	Cloves	357	Vanilla extract
931	Cinnamon	857	Peppermint extract
542	Fabric softener	319	Cedar chips
112	Instant coffee	115	Cocoa
127	Tea leaves	276	Onion
213	Bleach	601	Chili powder
719	Sauerkraut	573	Paint thinner
443	Lemon juice		

EVALUATION:

Ask the following questions:

1. How many of the fifteen substances did you identify correctly?
2. What is the highest number of correct answers by anyone in the class?
3. What does this experiment tell you about the interaction of the senses?

TEACHER NOTES:

Experiment will take approximately thirty minutes. Answers will vary, depending on how skilled students are at identifying odors.

STATE GOALS:

BPS1-8-P3; BPS1-1 2-M3; BPS3-8, 10-A1; BPS3-8, 10-A2; BPS3-8-A5; BPS3-8, 10-B3; BPS3-8-B1; BPS3-8-B4; BPS3-8-B6; BPS3-12-A,B; BPS4-8,10-C1; BPS4-8,10-D1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-8,10-M1; BPS4-12-A.M; LA1-8,10,12-A2; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-G1; LA2-8-B2; LA2-8-D1; LA2-8-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-B1; LA3-8,10,12-C1; LA4-8-A1; LA4-8-C2; LA4-8-D1; LA4-8-D2; LA6-8-A1; LA6-8,10-C2; LA6-8-C1.

Courtesy of *Food Science and You*, Merrill Publishing Company

ODOR RECOGNITION

Experiment

Normally, the senses of sight, odor, taste, touch, and, sometimes, hearing are used in evaluating products. When one sense is isolated, identification of even well-known samples can be difficult. This experiment will test your ability to identify common products by odor alone.

Materials:

- Fifteen samples of odorous materials in coded containers
- Handkerchief or cloth for a blindfold

Procedure:

1. Work with a partner.
2. There are fifteen samples of odorous material in coded containers.
3. You will be blindfolded, and your partner will present each sample for your evaluation. Sniff each of the fifteen samples. Your partner will record what you believe each sample on your data table is. Your partner should not sniff the samples while presenting them to you.
4. Reverse roles and allow your partner to sniff each sample while you record the results.

Sample Data Table

Code	Blindfolded Identification	Actual Identity of Substance

Questions:

1. How many of the fifteen substances did you identify correctly?
2. How many did your partner identify correctly? What was the highest number of correct answers by anyone in the class?
3. What does this experiment tell you about the interaction of the senses?

Courtesy of *Food Science and You*, Merrill Publishing Company

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TASTE BUDS SENSE FLAVORS

OBJECTIVES:

Detect location of taste centers on the tongue.
Identify kinds of tastes the tongue can recognize.
Demonstrate responsibility for carrying out an experiment.
Relate to and communicate with others.

MATERIALS:

One copy of **Stick Out Your Tongue and Say, Ah!** experiment worksheet for each student
Where Are the Taste Buds on Your Tongue? transparency
Four cotton swabs per student
Salt
Sugar
Sodium bicarbonate (baking soda)
Lemon juice
Four beakers

PREPARATION:

1. Prepare four solutions by dissolving each substance in water at a ratio of 1 teaspoon per cup of water.
2. Label each solution accurately: salty, sweet, sour, bitter.

PROCEDURE:

1. Introduce experiment by having students look at or mentally picture their tongue while you ask a series of questions:
   a. What does it look like? Rough? Smooth? Bumpy?
   b. What does the tongue do?
   c. What kinds of taste do you think the tongue identifies?
2. Explain that students are going to make a map of their tongue to identify where the different taste centers are located.
3. Form lab groups of two students each.
4. Distribute experiment worksheets and cotton swabs.
5. Review directions emphasizing sanitary use of cotton swabs. Use own swabs and a different one for each solution. Avoid touching the tongue with the swab.
6. Explain procedure to obtain solutions at supply table.
7. Allow five to ten minutes to map tongues.
8. Display transparency and have students respond as to where they tasted each of the four solutions. Students may map their tongues differently. Explain there is overlapping of taste sensations, especially sweet, salty, and sour tastes. Some substances affect more than one taste.
9. Discuss worksheet questions. Explain taste buds are where the four tastes are sensitized on the tongue. Describe a taste bud.

EXPECTED DATA:

See transparency.

EVALUATION:

Completed in Steps 7 and 8 of procedure.

TEACHER NOTES:

The concentrations do not have to be precise. The purpose is to create a solution which obviously tastes sweet, salty, sour, or bitter.

STATE GOALS:

BPS1-8-P3; BPS1-12-M3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8,10-B2; BPS3-8,10-B3; BPS3-8-B1; BPS3-8-B5; BPS3-8-B6; BPS3-12-A.B; BPS4-8-A1; BPS4-8,10-B1; BPS4-8,10-C1; BPS4-8,10-D1; BPS4-8,10-E1; BPS4-10-F1; BPS4-10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-8,10-M1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-G1; LA1-8,10,12-B3; LA2-8-B2; LA2-10-B3; LA2-8,10,12-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8-C2; LA4-8-D1; LA4-8-D2; LA6-8-C2; LA6-10-C1; M6-12-A1.

Courtesy of *Food Your Choice–Science*, National Dairy Council

STICK OUT YOUR TONGUE AND SAY, AH!

Experiment

The sense of taste allows you to enjoy a variety of food flavors. This experiment identifies the different taste sensations and detects where taste centers, or taste buds, are located on your tongue.

Materials:

Eight cotton swabs
Four containers such as beakers or paper cups
Sodium bicarbonate solution
Sugar solution
Lemon juice
Salt solution

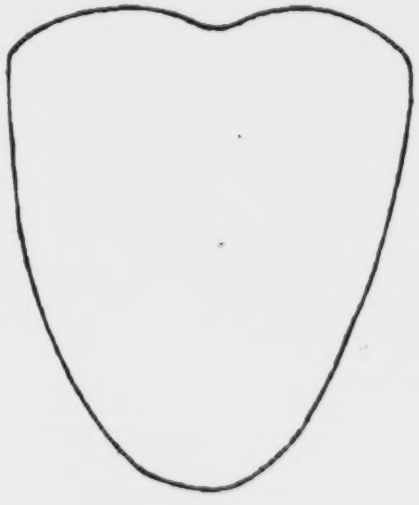
Procedure:

1. Work with a partner.
2. Label containers **Salty, Sweet, Sour,** and **Bitter**.
3. Go to supply table and pour small quantities (30 cc) of the four solutions into the appropriate containers.
4. Using a cotton swab, have your partner put a drop of the "salty" solution on a specific part of your tongue. **Do Not** touch the tongue with the swab.
5. Continue putting drops on different sections of the tongue, until you taste the solution.
6. Write the word **Salty** on the tongue drawing at the point where the taste occurred.
7. Continue mapping the tongue for the other three solutions. Use different swabs for each solution.
8. Reverse roles and repeat experiment.
9. Be certain to follow all laboratory safety procedures. If you have any questions, check with your teacher.

Questions:

1. What are the functions of the human tongue?

2. What are taste buds? How do they function?



Courtesy of *Food Your Choice—Science*, National Dairy Council

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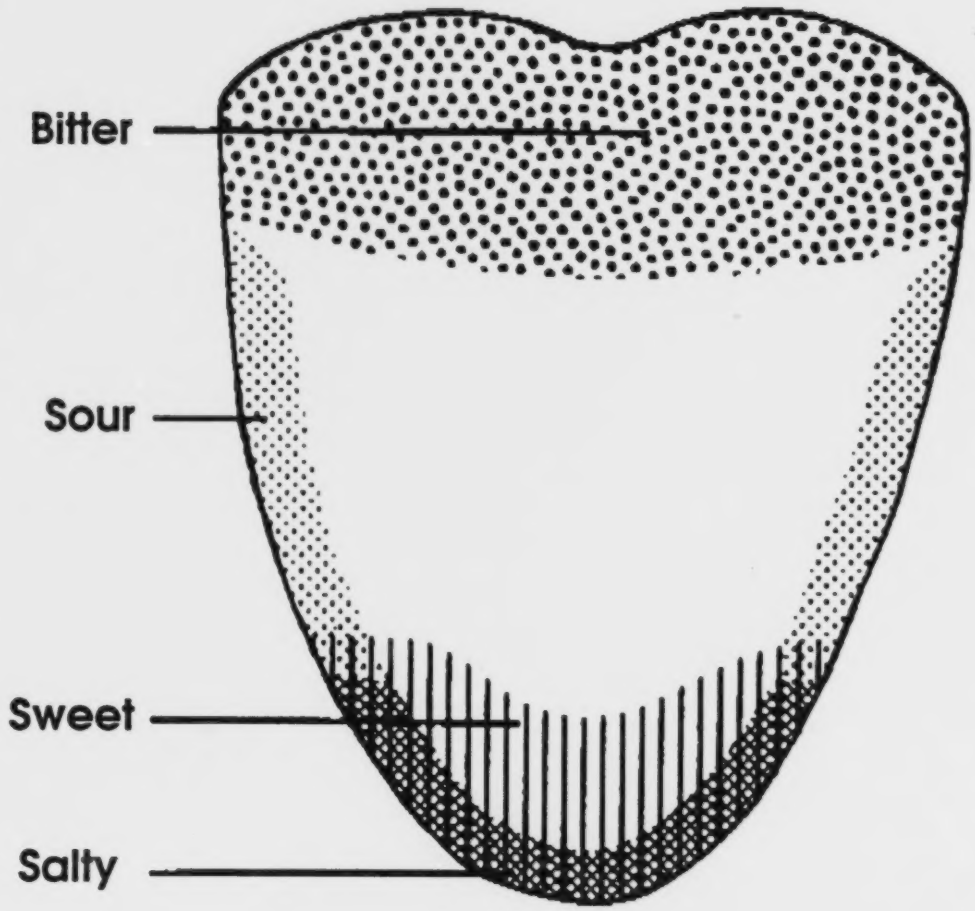
WHERE ARE THE TASTE BUDS ON YOUR TONGUE?



Courtesy of *Food Your Choice—Science*, National Dairy Council

TRACING HOW FOOD IS TURNED INTO USABLE NUTRIENTS BY DIGESTION: A

OBJECTIVES:

Name and describe the parts of the human digestive system.
Identify where to locate and how to use information.
Demonstrate responsibility for carrying out a project.

MATERIALS:

One copy of **Your Internal Food Processor** worksheet per student
One copy of **Making Digestion Digestible** project sheet per student
Transparency or poster diagram of the digestive system
30' (9 m approximate) flexible rubber tubing or clothesline
Marker or colored tape
Lubricating (petroleum) jelly
Plastic or metal ball (7 mm in diameter)
1' (30 cm) flexible rubber tubing, 1/4" (6 mm) in diameter
Clear or translucent jar or jug with 2 quart (1.9 liter) capacity

PREPARATION:

1. Fill jar or jug with 1 1/2 quarts (1.4 liters) of water.
2. Mark off the following sections on the flexible rubber tubing or clothesline with marker or colored tape:
   a. **Esophagus**: 10" (25 cm) down from the top
   b. **Stomach**: a measurement equal to the height of the jar starting from the bottom of the esophagus mark
   c. **Small Intestine**: 20' (6 m) down from the stomach mark
   d. **Large Intestine**: 5' to 6' (1.5 to 1.8 m) down from the small intestine mark
   e. **Rectum**: 7" to 8" (17 to 20 cm) down from the large intestine mark

PROCEDURE:

1. Introduce activity with the following questions:
   a. Have you ever thought about where your food goes after you swallow?
   b. Does your food stop moving when you lie down?
   c. Do you know how your body digests food?
2. Distribute **Your Internal Food Processor** worksheets.
3. Give students three to five minutes to fill in 1 through 6 on the worksheet.
4. Display transparency or poster diagram of digestive system.
5. Students check and correct worksheet as teacher names and describes parts of the digestive system. Use **Living Science** content outline (II C 2-4) for descriptions.
6. Use prop materials to visualize digestive process.
   a. Show size or length of each organ on tubing or clothesline model.
   b. Demonstrate peristalsis motion with ball and tubing.
      1) Coat ball with lubricating jelly. (The ball represents a piece of food, the jelly is the saliva, and the tube is the esophagus.)
      2) Insert ball into one end of a rubber tube and push as far as possible with the blunt end of a pencil.
      3) Squeeze the tube above the ball with the thumb and index finger of one hand.
      4) Squeeze the tube about 1" (2.5 cm) below the ball with the thumb and index finger of the other hand.

5) Push both hands toward the ball, still squeezing at the top.
6) After ball moves, relax the hand above the ball.
7) Continue to squeeze, push, and release until the ball comes out the other end of the tube.

c. Display water jug as stomach example.

7. Distribute **Making Digestion Digestible** project sheet.
8. Review directions for project.
9. Students sign up for project and choice of partner or independent study.
10. Set date for presentations.
11. Have students present projects to class on assigned dates.

EXPECTED DATA:

1. Mouth
2. Esophagus
3. Stomach
4. Small intestine
5. Large intestine
6. Anus

EVALUATION:

Completed in Step 5 and 11 of procedure.

TEACHER NOTES:

Visual prop materials can be reused, making the preparation time and investment worthwhile. Obtain old X-rays of hospital patients who had barium studies taken of the gastrointestinal tract. Mount on white paper to provide a contrasting view of various organs. A follow-up activity could trace the movement of a piece of food, such as a peanut butter sandwich, through the digestive system.

STATE GOALS:

BPS1-8-N2; BPS1-8-P1; BPS1-10-K1; BPS1-12-N3; BPS3-8-A2; BPS4-10-I1; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-D1; LA1-8,10,12-G1; LA2-8,10-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-8-B2; LA2-10-B3; LA3-8,10-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA3-8,12-F1; LA3-8-F2; LA3-10-F3; LA4-8-A1; LA4-8,10-B3; LA4-8-C1; LA4-8,12-D1; LA4-8,10-D2; LA4-8-D3; LA4-8,10,12-E1; LA4-8,12-E2; LA4-8,10-E5; LA4-12-E3; PDH2-8-F3.

Courtesy of *Food Your Choice–Science*, National Dairy Council

YOUR INTERNAL FOOD PROCESSOR

Worksheet

Directions: Identify numbers 1 through 6 of the digestive system.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Take notes during class discussion.

You may want to use the spaces provided below.

Anus (A nus) _____

Bile (Buy el) _____

Esophagus (es off a gus) _____

Gall bladder _____

Large intestine _____

Liver _____

Mouth _____

Pancreas (Pan cree us) _____

Peristalsis (Pear is tall sis) _____

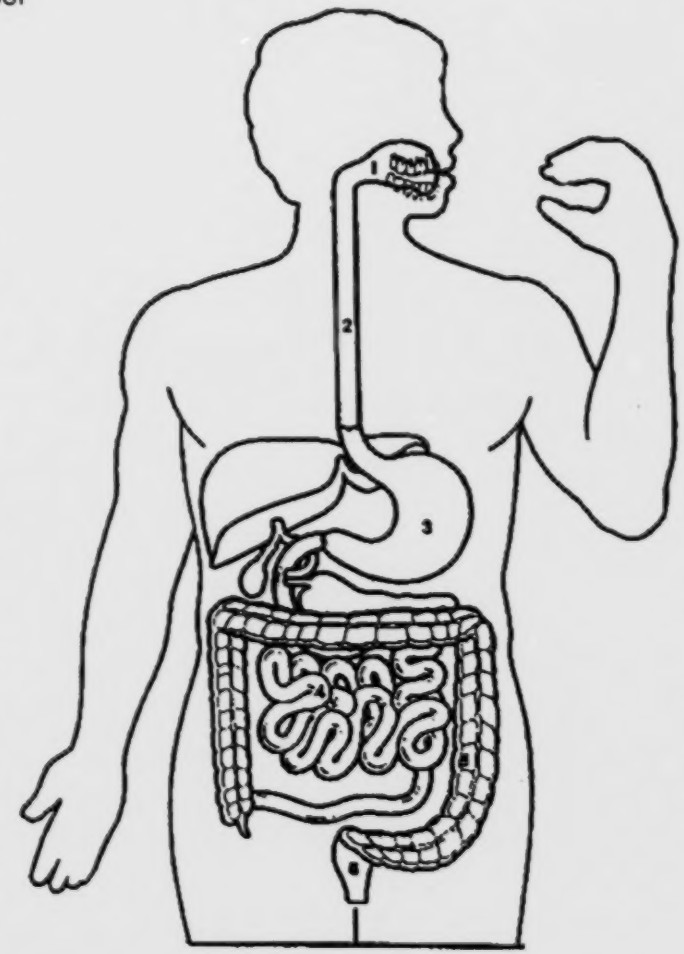
Rectum (Wreck tum) _____

Saliva (sa lye vah) _____

Small intestine _____

Stomach _____

VIIII (VIII eye) _____



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Courtesy of *Food Your Choice—Science*, National Dairy Council

MAKING DIGESTION DIGESTIBLE

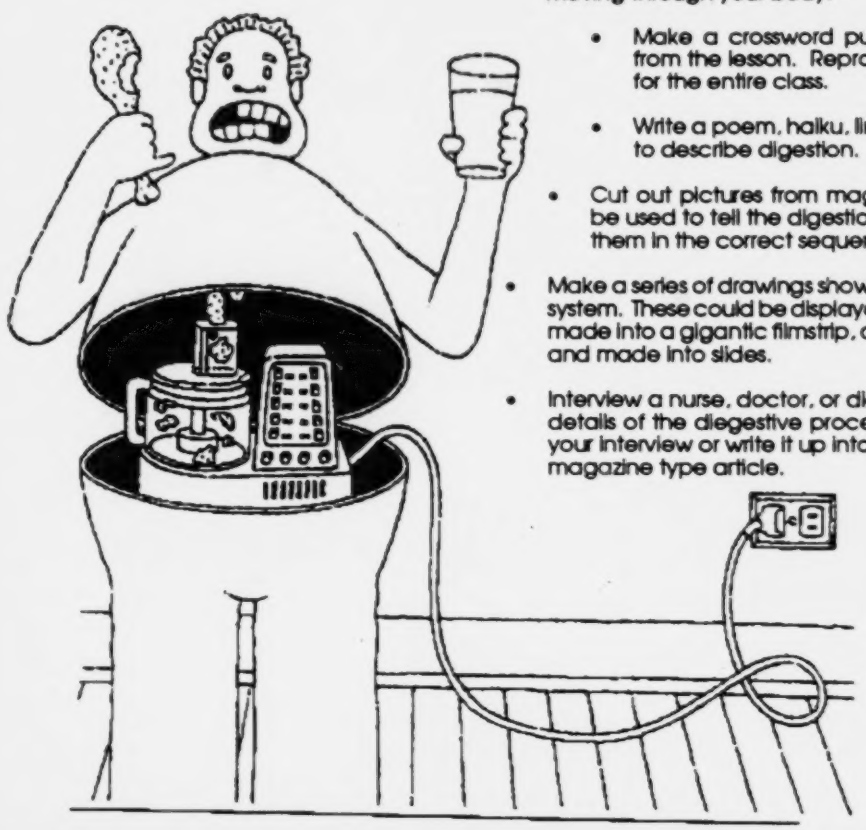
Worksheet

You have been assigned to do a project on digestion. You can work alone, with a partner, or with a group of other students. Your project should demonstrate one or more of the following ideas.

- **How food moves though the digestive system.**
- **The key function of each of the organs in the digestive system.**
- **How food is digested and absorbed and waste products are eliminated.**

PROJECT SUGGESTIONS:

- Make a drawing comparing the digestive system to a factory, a recycling plant, or anything else—real or imaginary—that seems appropriate.
- Create a series of dance steps and movements to show food moving through the organs of the digestive system.
- Take a popular tune and write new lyrics to describe digestion.
- Use any 3-dimensional materials to make a model of the digestive system.
- Create a road map for one of your favorite foods moving through your body.
- Make a crossword puzzle using terms from the lesson. Reproduce the puzzle for the entire class.
- Write a poem, haiku, limerick, or sonnet to describe digestion.
- Cut out pictures from magazines that can be used to tell the digestion story. Arrange them in the correct sequence on a poster.
- Make a series of drawings showing the digestive system. These could be displayed on a flip chart, made into a gigantic filmstrip, or photographed and made into slides.
- Interview a nurse, doctor, or dietitian about the details of the diegestive process. Tape record your interview or write it up into a newspaper or magazine type article.



Feel free to come up with other ideas of your own, too.

SA-82

Courtesy of *Food Your Choice—Science*, National Dairy Council

TRACING HOW FOOD IS TURNED INTO USABLE NUTRIENTS BY DIGESTION: B

OBJECTIVES:

Identify organs responsible for digestion and absorption in the human digestive system.
Name specific organs in which carbohydrate, fat, and protein digestion occur.
Indicate organs where absorption of food and water occur.
Read and follow directions.

MATERIALS:

One copy of **Put The Digestive Organs To Work** worksheet for each student
Colored pencils for students to share: red, blue, green, yellow, purple

PROCEDURE:

1. Introduce activity by telling students this activity will be a review of the digestive system. They will identify where food is converted into the nutrients needed for body functioning.
2. Distribute worksheets and review directions.
3. Allow students time to complete in class or assign as homework.
4. Students share responses to worksheet questions and conclusions.

EXPECTED DATA:

1. Small intestine
2. Small intestine: it makes several enzymes and is the site of most digestion and all absorption of digested food.
3. Pancreas: enzymes needed to digest fats, protein, and carbohydrates are made here.
4. Salivary glands (mouth), pancreas, small intestine
5. Stomach, small intestine
6. Liver, pancreas
7. Small intestine absorbs food, and large intestine absorbs water.

Conclusion:
To digest, absorb, and eliminate food that is eaten

EVALUATION:

Completed in Step 4 of procedure and by checking labeling and coloring of diagrams.

TEACHER NOTES:

Provide students with another copy of digestive system diagrams and have them color in those organs responsible for chemical, physical, or both chemical and physical changes. Completed diagrams should show type of coloring code used. Results show the following: chemical—salivary gland, pancreas, small intestine; physical—liver, gallbladder; physical and chemical—mouth, stomach.

STATE GOALS:

BPS1-8-B1; BPS1-8-N1; BPS1-8-K1; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10, 12-A3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-G1; LA2-8-B2; LA2-8,10,12-D1; LA2-8,10,12-F1; LA2-8,10,12-F2; LA2-10-B3; LA3-8,10-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA3-12-D1; LA4-8-D1; LA4-8-D2; LA4-8,12-E2; LA6-8-A1; LA6-8-C2; LA6-10-C1; PDH2-8-F2; PDH2-8-F3.

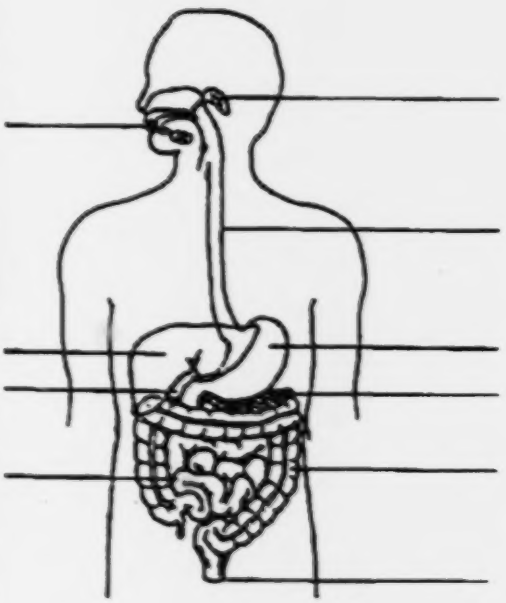
Courtesy of *Biology: An Everyday Experience*, Merrill Publishing Company

PUT THE DIGESTIVE ORGANS TO WORK

Worksheet

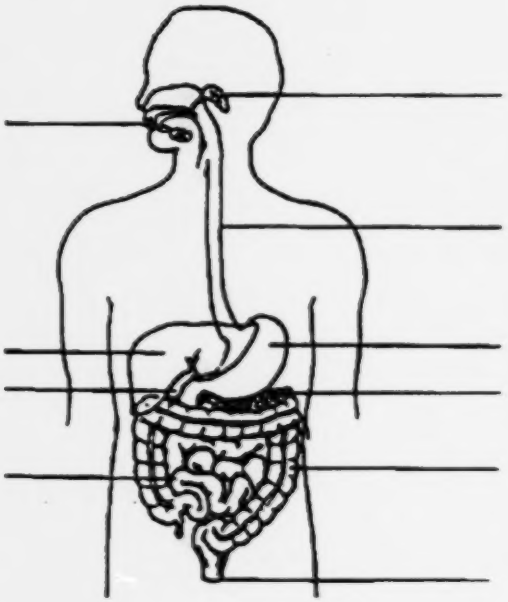
Directions: Follow instructions in each box under the diagram.

Human Digestive System.



1. Label the esophagus, large intestine, mouth, liver, small intestine, gallbladder, pancreas, salivary gland, stomach, and anus.
2. With a lead pencil, shade only the parts through which food actually passes.

Organs That Help To Digest Carbohydrates.



1. Color red only the organs that aid the chemical change of carbohydrates.
2. Label these organs.

(continued)

Courtesy of *Biology: An Everyday Experience*, Merrill Publishing Company

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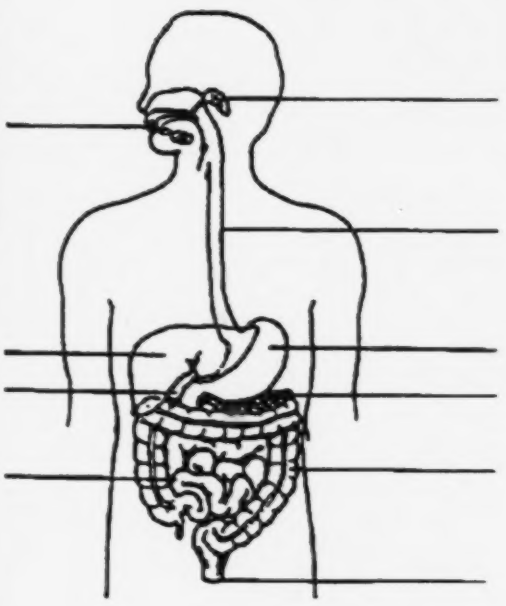
PUT THE DIGESTIVE ORGANS TO WORK

Worksheet (cont.)

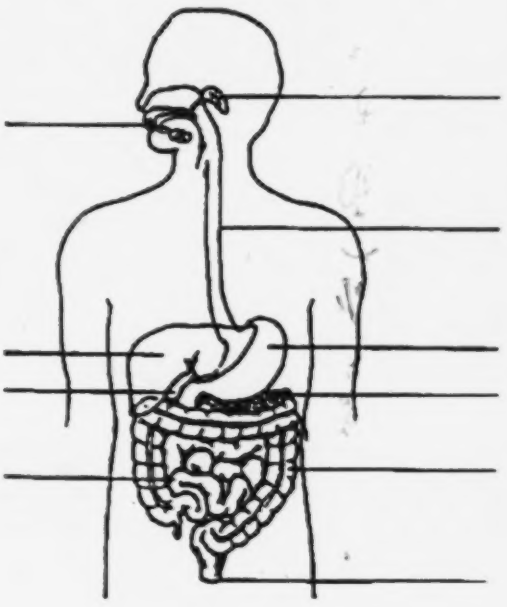
Directions: Follow instructions in each box under the diagram.

Organs That Help To Digest Protein



1. Color blue only the organs that aid the chemical change of protein.
2. Label these organs.

Organs That Help To Digest Fat



1. Color green only the organs that help with chemical and physical changes of fat.
2. Label these organs.

(continued)

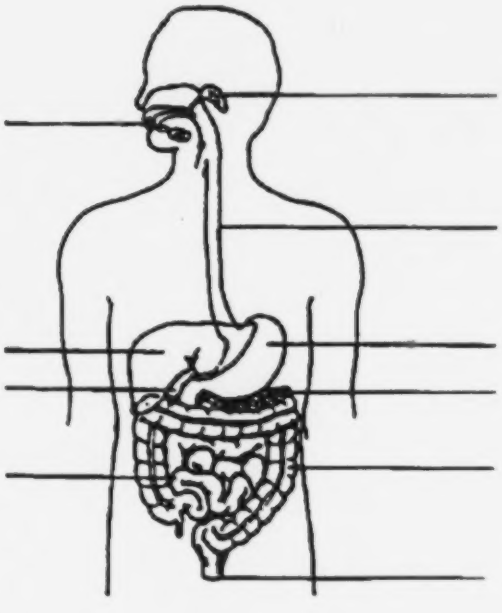
Courtesy of *Biology: An Everyday Experience*, Merrill Publishing Company

PUT THE DIGESTIVE ORGANS TO WORK

Worksheet (cont.)

Directions: Follow instructions in each box under the diagram.

Organs That Help Absorb Digested Food and Water



1. Color yellow only the organs that aid the absorption of digested food.
2. Label these organs.
3. Color purple only the organs that aid the absorption of water.
4. Label these organs.

Questions:

1. Which organ appears most used in all the diagrams?
2. Which organ seems to be most important in the digestive system? Why?
3. Which organ appears to be the next most important in digestion? Why?
4. Which organs help digest carbohydrates?
5. Which organs help digest protein?
6. Which organs help digest fat?
7. Which organs help absorb digested food and water?

Conclusion: What are the jobs of the digestive system organs?

INCREASING SURFACE AREA ALLOWS GREATER ABSORPTION

OBJECTIVES:

Distinguish that villa increase the surface of the intestine.
Determine the relationship between surface area and the process of absorption.
Predict effect of removing a portion of the small intestine.
Read and follow directions.

MATERIALS:

One copy of **Measure the Intestine** worksheet for each student
Two 18" pieces of string per student
Scissors for each student
Meter stick for each student

PROCEDURE:

1. Introduce activity by describing the villa and its purpose on the lining of the small intestine. Ask how the villa can make the surface larger? How much larger? This activity should convince you that the larger the surface area of the intestine, the better the chances that food molecules will come into contact with it and be absorbed into the blood stream.
2. Distribute worksheet, string, scissors, and meter sticks.
3. Review directions. Emphasize the following:
   a. Circle B should contain many more folds to illustrate the extensive surface area created by villi.
   b. Drawing has been simplified to allow for ease in measuring.
4. Students complete measuring activity.
5. Students share responses to these questions:
   a. What was the string measurement for circle A? Circle B?
   b. Why was the string for circle B longer? How many times longer than circle A?
   c. What effect does this have on absorption of digested food nutrients? Does the food have to be digested first?
   d. Where is the food in the bloodstream going when it leaves the villa?
6. Explain that a section of the small intestine is removed in an operation called intestinal bypass. Have students speculate as to why this kind of operation results in weight loss.

EXPECTED DATA:

Exact measurements will vary, but the inside of circle B is three times longer than the inside of circle A. Villa make the surface larger. The larger surface means digested food is absorbed better. The blood circulates throughout the body carrying nutrients to the cells.

Having less intestine means less absorption of food, and weight loss is the result. Health problems may include diarrhea, vitamin and mineral deficiency, and dehydration.

EVALUATION:

Completed in Steps 4, 5, and 6 of procedure.

TEACHER NOTES:

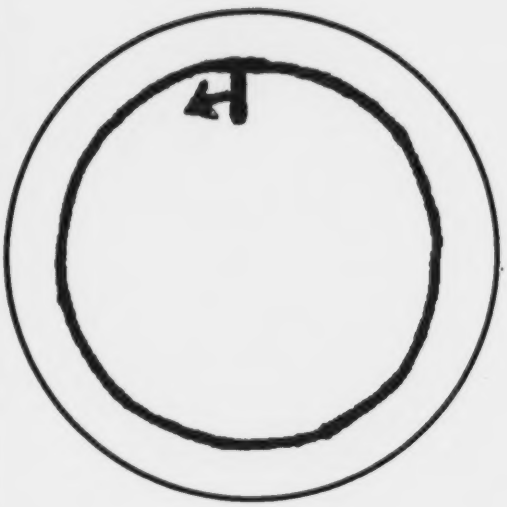
This activity may be done as a teacher demonstration using a transparency of the circles. Allow several students to volunteer to position and measure the string lengths.

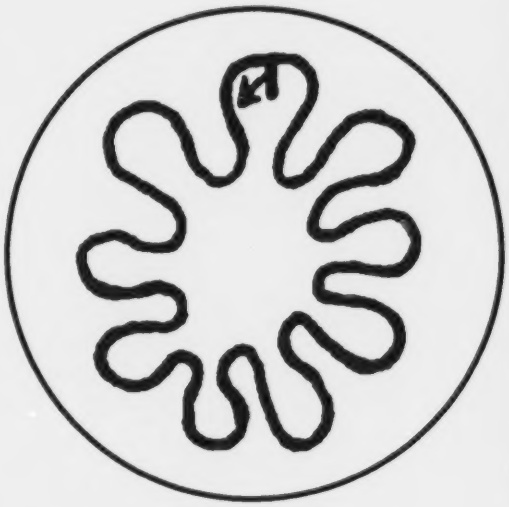
STATE GOALS:

BPS1-8-P1; BPS1-10-K1; BPS3-8-B5; BPS3-8-B1; BPS3-10-B3; BPS3-12-A.B; BPS4-8,10-A1; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-G1; LA2-8-B2; LA2-8,10-D1; LA2-8,10-D2; LA2-8,10-F3; LA2-8,10-F4; LA2-10-B3; LA3-8,10,12-B1; LA3-8,10,12-C1; LA4-8-A1; LA4-8-D1; LA4-8-D2; LA6-8-A1; LA6-8,10-C2; LA6-10-C1; M1-12-C1; M7-8,10,12-E1; M7-8,10-E5.

MEASURE THE INTESTINE

Worksheet





CIRCLE A

1. Place a piece of string around the inside of circle A.
2. Cut off any extra string so it fits exactly.
3. Measure the string in centimeters.

CIRCLE B

1. Place a piece of string around the inside of circle B. Follow curves exactly.
2. Cut off any extra string so it fits exactly.
3. Measure the string in centimeters.

Which string is longest? _____

How many times longer? _____

Why? _____

_____

_____

_____

Courtesy of *Biology: An Everyday Experience*, Merrill Publishing Company

FOOD MOVES THROUGH THE ENTIRE DIGESTIVE SYSTEM

OBJECTIVES:

Prepare pie graph showing food's digestive time in each organ.
Demonstrate responsibility for carrying out activity.
Organize and manage human and material resources.

MATERIALS:

One copy of **Digestive System Pie** worksheet for each student
Protractor for each student

PROCEDURE:

1. Distribute worksheets and protractors.
2. Review directions and demonstrate how to use protractor.
3. Circulate throughout classroom monitoring students' work.
4. Collect and display pie graphs.

EXPECTED DATA:

Digestion in the mouth and esophagus is less than one degree on the graph. Digestion in both the stomach and large intestine is 72 degrees, and digestion is 216 degrees in the small intestine.

EVALUATION:

Determine accuracy of measurements by comparing student graphs with expected data information.

TEACHER NOTES:

Increase difficulty by having students research resources and classnotes for names of organs and relative time spent in each organ.

STATE GOALS:

LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA2-8-B2; LA2-8,10,12-D1; LA-10-B3; M1-8-B4; M1-8,12-C1; M2-8,10-B1; M6-8-A1; M7-8,10,12-E1; M7-8,10-E4; M7-8,10-E5; M7-8,10-E6; M7-8,10,12-G1.

DIGESTIVE SYSTEM PIE

Worksheet

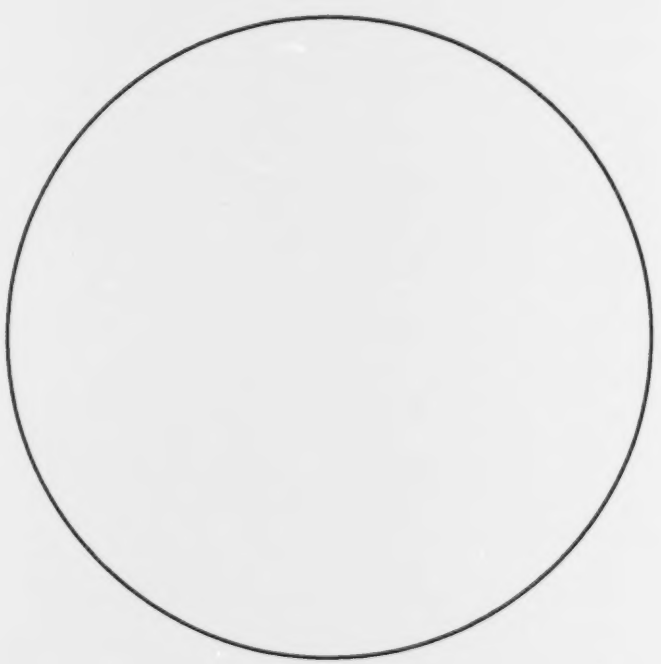
Directions: Prepare a pie graph showing how long food spends in each organ during the digestive process.

1. Use the following data:
   - mouth — 2 minutes
   - esophagus — 1 minute
   - stomach — 240 minutes
   - small intestine — 720 minutes
   - large intestine — 240 minutes

2. To find the number of degrees in each pie segment, do the following:
   a. divide the time in each organ by 1,200 (the total time in minutes).
   b. multiply by 360 (total degrees in the pie).

3. Use a protractor to mark the degrees around the circumference; then draw a line from the mark to the center.

4. Label segments with organ name and time.



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SA-95

OSMOSIS REGULATES THE CONCENTRATION OF THE BODY'S CHEMICALS ON EITHER SIDE OF A CELL MEMBRANE

OBJECTIVES:

Observe the process of osmosis.
Determine the role osmosis plays in daily life.
Demonstrate responsibility for carrying out an activity.

MATERIALS:

One copy of **Osmosis—Travel Through a Membrane** experiment worksheet per student
One copy of **What Happened to the Salad?** worksheet per student
Egg
250 mL beaker
1/2 cup (125 mL) each of vinegar and corn syrup
Four to five dried lima beans
Per Lab Group:
- 250 mL beaker
- Egg
- 1/2 cup (125 mL) vinegar
- 1/2 cup (125 mL) water, vinegar, corn syrup, or salt-water solution
- Meter stick
- Masking tape
- Marking pen

PREPARATION:

1. Soak two to three lima beans overnight prior to students' experiment.
2. Prepare an egg for class demonstration by conducting experiment along with students.
3. Prepare salt-water solution for Variation 4 on fourth day.

PROCEDURE:

1. Introduce activity by displaying both dried, unsoaked lima beans and dried lima beans which you have soaked overnight. Ask students how they differ. (The soaked beans are greatly enlarged and some have split open.) What must have happened to the seeds to cause them to change? (Water must have passed through the coating to the inside of the seeds, causing them to swell up.)
2. Explain that movement of a substance from a place of greater concentration to a place of lesser concentration is called diffusion. When water and certain chemicals move into and out of a cell by diffusion, the process is called osmosis. This activity will allow you to observe osmosis through a semi-permeable membrane of an egg.
3. Divide class into lab groups of two students each.
4. Distribute **Osmosis—Travel Through a Membrane** experiment worksheets and review instructions.
5. On fourth day, demonstrate how to remove the shell from an egg after it has soaked in vinegar for three days. Hold the egg in the palm of one hand. Place it under running water and use the thumb of the other hand to gently wipe away the thin layer of shell until the membrane underneath is exposed. This must be done very carefully to avoid puncturing the membrane.

6. Assign variations to lab groups. Provide solutions for covering eggs.
7. On fifth day, have students provide data for their variation on the chalkboard.
8. Discuss questions and results with class.
9. Demonstrate that changes due to osmosis are reversible.
   a. Immerse a swollen egg in corn syrup for a day. It will lose water and appear limp and shriveled.
   b. Place it in clear water for a day. It will return to normal size.
10. Have students suggest examples of osmosis.
    a. crisping vegetable relishes
    b. watering houseplants
    c. misting grocery produce
    d. moving water and nutrients from digestive tract into the blood stream
11. Distribute **What Happened to the Salad?** worksheets.
12. Discuss possible explanations.

EXPECTED DATA:

Variation	Initial Liquid Height	Height/ Appearance After 30 Minutes	Height After 24 Hours	Appearance of Egg After 24 Hours	Appearance of Liquid After 24 Hours
1	5.0 cm	5.0 cm	4.5 cm	swollen	thicker, foamy
2	6.0 cm	6.0 cm	5.5 cm	swollen	thicker, foamy
3	6.0 cm	6.0 cm	6.5 cm	shriveled	runny, thin
4	6.5 cm	6.5 cm	6.5 cm	normal	clear, unchanged

1. Answers will vary. Water goes into the egg immersed in the tap water and vinegar, while water leaves the egg in corn syrup. This is obvious from the change in the size of the egg after 24 hours. No apparent change occurs in the egg immersed in salt water.
2. They are shriveled.
3. The eggs in corn syrup lost the most water because the concentration of water was lower in the corn syrup than in the eggs. The eggs in the pure water gained the most water because the concentration of water was higher outside the eggs than inside them.

A. Work backwards; guess and check. Discuss what was used to season the salad—salt, pepper, spices.

B. The water moved out of the vegetables by diffusion (osmosis) from where it was in large concentration to the droplets of salt solution where it was in small concentration.

EVALUATION:

Completed in Steps 8 and 12 of procedure.

TEACHER NOTES:

This experiment takes five days with student participation only three of the five.

STATE GOALS:

BPS1-8-B1; BPS1-8-G2; BPS1-8-C3; BPS1-8-F3; BPS1-8-P4; BPS1-10-L2; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8,10-B3; BPS3-8-B5; BPS3-8-B6; BPS3-8-B1; BPS3-10-B2; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-C1; BPS4-8,10-D1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8-M1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1.

OSMOSIS–TRAVELING THROUGH A MEMBRANE

Experiment

Osmosis is the passage of water and other liquids through a semipermeable membrane. In metabolism, it acts to regulate the concentration of substances on both sides of the membrane. Eggs contain a membrane through which osmosis can take place. In this experiment, you will determine whether water flows primarily in or out of an egg by observing changes in liquid level and the size of the egg.

Materials:

250 mL beaker
Egg
1/2 cup (125 mL) vinegar
1/2 cup (125 mL) water, vinegar, corn syrup, or saltwater solution
Meter stick
Masking tape
Marking pen

Procedure:

1. Place an egg (still in the shell) in a 250 mL beaker containing enough vinegar to cover the egg. Let stand for three days.
2. Pour out vinegar and carefully rinse any remaining shell off egg, leaving the egg sac.
3. Carefully place the egg (which now has no shell) in a clean 250 mL beaker. Follow the variation assigned by your teacher.
   a. **Variation 1.** Add water to completely cover the egg.
   b. **Variation 2.** Add vinegar to cover the egg.
   c. **Variation 3.** Add corn syrup to cover the egg.
   d. **Variation 4.** Add a saltwater solution to cover the egg.
4. Measure the height of the liquid in the beaker and record it in your data table.
5. After thirty minutes, measure the level of the liquid in the beaker and note any appearance changes in the egg and the liquid. Record these in your data table.
6. Label the beaker with your name, variation number, and class period. Cover it with plastic wrap. Leave it overnight in the location designated by your teacher.
7. The following day, measure the liquid level and observe the appearance of the egg and the liquid. Note any evidence of layers separating in the liquid. Record the information in your data table.
8. Record the heights of your liquid and the appearance of the egg and the liquid on the chalkboard. In your data table, record the height and appearance information for other variations.

Questions:

1. Did more water go into or out of your egg membrane?
2. Describe the appearance of any eggs that lost water.
3. Which eggs lost the most water? Gained the most? Why?

Sample Data Table

Variation	Initial Liquid Height	Height/ Appearance After 30 Minutes	Height After 24 Hours	Appearance of Egg After 24 Hours	Appearance of Liquid After 24 Hours

Courtesy of *Food Science and You*, Glencoe Publishing Company SA-101

WHAT HAPPENED TO THE SALAD?

Worksheet

Directions: Read the following situation and determine what happened.

Carla prepared a salad of lettuce, tomatoes, carrots, cucumbers, radishes, and other fresh, crisp vegetables. She seasoned the salad with herbs, salt, pepper, oil, and vinegar. She then tossed the salad to mix everything and placed it in the refrigerator about an hour before dinner.

When Carla took the salad from the refrigerator, the lettuce had wilted and the other vegetables were limp. In addition, there was more liquid in the bottom of the bowl than she had originally added.

A. What could Carla do to find the cause of what happened to her salad?

B. What do you think had taken place?

Courtesy of *Focus on Life Science*, Merrill Publishing Company

ACKNOWLEDGING THE CAUSE AND EFFECT OF A DYSFUNCTIONAL BODY SYSTEM

OBJECTIVES:

Describe and explain the cause and effect of an ulcer and heartburn.
Identify where to locate and how to use information.

MATERIALS:

Pepsin enzyme (available from chemical supply house)
Hydrochloric acid
100 mL graduated cylinder
Two 100 mL beakers
Chunks of meat or hard-cooked egg white
Petroleum jelly
One copy of **Spot the Ulcer, Check the Heartburn** worksheet for each student

PREPARATION:

Prepare a 10% solution of pepsin enzyme in a 100 mL graduated cylinder.

PROCEDURE:

1. Introduce lesson by asking if anyone knows what causes an ulcer? Heartburn? This experiment will simulate the action of protein-digesting enzymes that cause ulcers in the stomach or small intestine. We'll also determine what causes heartburn.
2. Distribute worksheets.
3. Demonstrate the effect of acid in causing an ulcer in the stomach or small intestine:
   a. Add 20 mL of the pepsin enzyme solution to a 100 mL beaker. Label: Beaker 1.
   b. Add 5 drops of concentrated hydrochloric acid to the beaker. **CAUTION:** Acid is corrosive.
   c. Place a piece of protein (chunk of meat or hard-cooked egg white) in the beaker.
   d. Repeat experiment with the piece of meat or egg coated in petroleum jelly. Label: Beaker 2.
4. Explain that students are to observe the protein, representing the stomach or intestine, in the two beakers daily and record observations.
5. Students conduct research for information to complete directions and questions on ulcers and heartburn.

EXPECTED DATA:

The piece of protein representing the stomach or small intestine lining in Beaker 1 will be digested or "eaten" away causing an ulcer. The protein in Beaker 2 will not be digested due to the protective coating (petroleum jelly) on the stomach/intestine lining.

EVALUATION:

Completed in Steps 4 and 5 of procedure.

TEACHER NOTES:

Experiment can also be done by individual student lab groups if preferred.

STATE GOALS:

BPS1-10-I1; BPS1-10-K1; BPS3-8-A2; BPS3-8-A5; BPS3-8-B3; BPS3-8-B5; BPS3-8-B6; BPS3-8-B1; BPS3-10-B3; BPS3-10-B4; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-D1; BPS4-8,10-C1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-I1; LA1-8,10,12-A1; LA1-8,10,12-A3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-G1; LA2-8-B2; LA2-8,10-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10-B3; LA3-8,10,12-B1; LA3-8,10,12-C1; M6-12-A1; PDH2-8-F3; PDH2-10-R1; PDH2-8,12-J1; PDH2-10-A2.

SPOT THE ULCER, CHECK THE HEARTBURN

Worksheet

Directions:

Make observations daily of Beakers 1 and 2 to determine the effect of acid in causing an ulcer upon the lining of the stomach or the small intestine.

Sample Data Table

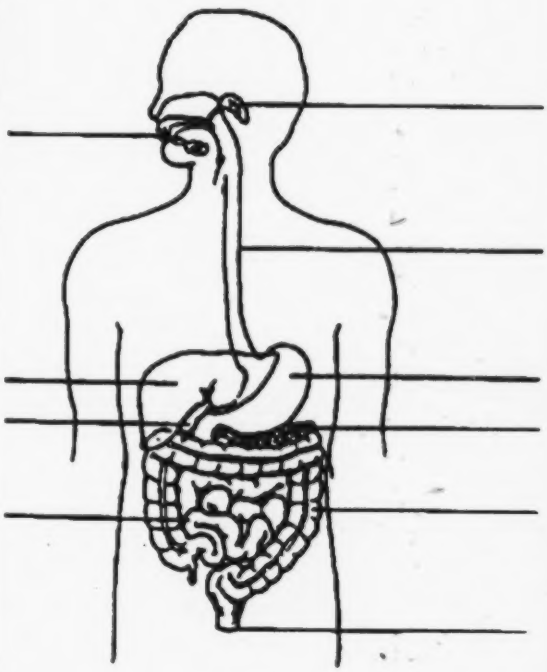
Day	Beaker #1	Beaker #2

Questions:

1. What does the piece of meat or egg represent?
2. What does the acid solution represent?
3. What causes an ulcer?
4. How does the stomach or intestine protect itself from excess acid?

Directions:

Locate the major organs that can be the site of an ulcer and heartburn. Label them. Research information regarding the major causes of heartburn.



Questions:

1. How did heartburn get its name?
2. How can the problem be prevented or helped?

IDENTIFYING NUTRIENT COMPOSITION BY CHEMICAL ANALYSIS

OBJECTIVES:

Determine nutrient composition of common foods.
Demonstrate responsibility for conducting food experiment.
Relate to and communicate with others.

MATERIALS:

Ten shelled peanuts
1/2 pint milk
One slice bread
One apple
Knife
Beaker or small container
Aluminum foil (starch, mineral tests)
Iodine in bottle with dropper (starch test)
Twenty-four test tubes (protein, vitamin tests)
Nine medicine droppers (protein, vitamin tests)
Biuret solution (protein test)
Three beakers or containers of water (protein, fat, vitamin tests)
Sixteen small pieces of plain brown paper (unwaxed paper bag type) (fat test)
Four to eight burners, asbestos pads, and ring stands (one to two hot plates) (mineral test)
Indophenol (vitamin test)
Experiment Station Instructions
One copy of **Taking Food Apart** worksheet for each student

PREPARATION:

1. Duplicate and cut apart **Experiment Station Instructions**.
2. Cut up the bread and the apple into ten pieces each. Pour half the milk into a beaker or container.
3. Set up the following (five) experiment stations:
   Carbohydrate (Starch) Station
   - aluminum foil
   - iodine
   - Carbohydrate Experiment Instructions

   Protein Station
   - eight test tubes
   - one beaker or container of water
   - medicine dropper
   - Biuret solution
   - Protein Experiment Instructions

   Fat Station
   - sixteen pieces of brown paper
   - one beaker or container of water
   - Fat Experiment Instructions

   Minerals Station
   - aluminum foil
   - four to eight burners, asbestos pads, and ring stands (or one to two hot plates)
   - Minerals Experiment Instructions

Vitamins Station

- sixteen test tubes
- one beaker or container of water
- Indophenol
- eight medicine droppers
- Vitamins Experiment Instructions

PROCEDURE:

1. Introduce experiment by asking if anyone knows what's in the foods they eat? Explain everyone will be testing an assigned food to determine its nutrients.
2. Divide class into eight groups. Assign two of the groups to each of the four different foods—milk, bread, peanuts, and apples.
3. Explain that the groups will be testing their foods for five classes of nutrients. Point out the five testing stations to the class. Instructions are at each station.
4. Distribute **Taking Food Apart** worksheets. Explain how to record experiment results.
5. Distribute food samples to appropriate groups—five pieces of apple or bread, five peanuts, or half the milk to a group.
6. Emphasize all five experiments must be completed in the class period. Suggest dividing up experiments among group members.
7. Review safety procedures.
8 Circulate around the room to supervise experiments and answer questions.
9. Have students clean up the experiment stations.
10. Upon completion, have students meet with their groups to compile experiment results.

EVALUATION:

Ask questions of students to compile test results.

1. Which of the four different types of food tested contain carbohydrates? (bread and apple)
2. Which of the four foods contain protein? (milk and peanuts)
3. Which of the four foods contain fat? (milk and peanuts)
4. Which of the four foods contain minerals? (milk and bread)
5. Which of the foods tested contain vitamins? (apple)
6. Did any of the foods tested provide all the classes of nutrients? (No single food provides all nutrients the body needs, and different foods provide different amounts of the nutrients.)

TEACHER NOTES:

If students are unfamiliar with nutrients, explain that nutrients are chemical substances; they work together and interact with body chemicals to build and repair body tissues, regulate body processes, and supply energy; and the body gets nutrients from food.

STATE GOALS:

BPS1-8-L1; BPS1-8-N1; BPS1-8-P3; BPS1-8-P4; BPS1-12-D3; BPS1-12-F2; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8,10-B2; BPS3-8,10-B3; BPS3-8-B5; BPS3-8-B1; BPS3-8-B6; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-B1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-8-M1; BPS4-8,10-C1; BPS4-8,10-D1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-G1; LA1-8,10,12-B3; LA2-8-B2; LA2-10-B3; LA2-8,10,12-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8-C2; LA4-8-D1; LA4-8-D2; LA6-8-C2; LA6-8-A1; LA6-10-C1; M6-12-A1; PDH2-8-F2; PDH2-10-A2.

Courtesy of *Food Your Choice–Science*, National Dairy Council

EXPERIMENT STATION INSTRUCTIONS

Duplicate and cut apart to have at appropriate experiment station.

Vitamins (Vitamin C)

Materials:
- Food sample
- 2 test tubes
- Water
- Medicine dropper
- Indophenol

Procedure:
1. Put a small amount (about 1/2 teaspoon) of your food sample in a test tube.
2. Add water (about 2 tablespoons). Don't add water if you have milk.
3. Shake the test tube to dissolve the sample in water.
4. Pour a small amount of indophenol (about 1 inch up from the bottom of the test tube) into another test tube.
5. Use a medicine dropper to add 1 drop of your food sample/water solution to the indophenol.
6. Shake the test tube to mix the 2 solutions.
7. Continue adding 1 drop and then shaking—until 5 drops have been added or until the blue color of indophenol disappears.
8. Record the color change on your Experiment Data worksheet. **The disappearance of the blue color indicates that vitamin C is present.**

Be sure to follow all laboratory safety procedures. If you have any questions, check with your teacher.

Fat

Materials:
- Food sample
- 2 pieces of plain brown paper
- Water

Procedure:
1. Rub (or drip) a small amount of your food sample on a piece of brown paper.
2. Drip a few drops of water on another piece of brown paper.
3. Let both dry for 3 minutes.
4. Shake off the food sample.
5. Hold both brown papers up to the light. If a water spot still shows, wave both papers in the air to dry until water spot disappears.
6. Record the results on your Experiment Data worksheet. **A grease spot indicates that fat is present.**

Be sure to follow all laboratory safety procedures. If you have any questions, check with your teacher.

Minerals

Materials:
- Food sample
- Aluminum foil
- Burner, asbestos, ring stand (or hot plate)

Procedure:
1. Place a small amount of your food sample on a piece of aluminum foil.
2. Heat for 5 minutes over the burner (or on a hot plate). Some foods will burn; some will smoke.
3. Record the results on your Experiment Data worksheet. **Any ash indicates that minerals are present.**

Be sure to follow all laboratory safety procedures. If you have any questions, check with your teacher.

Carbohydrates (Starch)

Materials:
- Food sample
- Aluminum foil
- Iodine

Procedure:
1. Place your food sample (or a few drops of milk) on a piece of aluminum foil.
2. Put a drop of iodine on the food sample.
   CAUTION: IODINE STAINS! HANDLE CAREFULLY!
   If color doesn't change much, add another drop of iodine.
3. Record the color change on your Experiment Data worksheet. **A blue-black color indicates that starch is present.**

Be sure to follow all laboratory safety procedures. If you have any questions, check with your teacher.

Protein

Materials:
- Food sample
- Test tube
- Water
- Medicine dropper
- Biuret solution

Procedure:
1. Put a small amount (about 1/2 teaspoon) of your food sample in a test tube.
2. Add water (about 3 tablespoons).
3. Let stand for 3 minutes.
4. Use a medicine dropper to add 10 drops of biuret solution.
5. Record the color change on your Experiment Data worksheet. **A reddish-violet to violet-blue color indicates that protein is present.**

Be sure to follow all laboratory safety procedures. If you have any questions, check with your teacher.

Courtesy of *Food Your Choice—Science*, National Dairy Council SA-109

TAKING FOOD APART

Worksheet

Directions: Test your food sample to determine the presence of carbohydrates (starch), protein, fat, minerals, or vitamins. Record your findings on the data table.

FOOD TESTED: _____

Nutrient Tested	What Happened? Write down any changes/differences such as smell, color, or form.	Is the Nutrient Present? Yes or No?
Carbohydrate (Starch)		
Protein		
Fat		
Minerals		
Vitamins (Vitamin C)		

Courtesy of *Food Your Choice–Science*, National Dairy Council

DETERMINING YOUR DAILY ENERGY (CALORIE) NEEDS

OBJECTIVES:

Calculate personal daily energy output.
Determine individual energy needs at various stages in the life cycle.
Identify where to locate and how to use information.
Read and follow directions.

MATERIALS:

One copy of **What's Your Energy Need?** and **How Do I Differ from Others?** worksheet for each student
Factors Affecting BMR transparency
Calorie Summary for the Life Cycle transparency

PREPARATION:

None

PROCEDURE:

1. Introduce activity by asking the following question:
"We know our body gets the energy it needs from the food we eat, but just how much energy does our body need? This activity will help you determine your energy needs.
2. Explain basal metabolism as the amount of energy needed to sustain life. Ask for examples of some of these autonomic processes (breathing, heartbeat, temperature control, tissue repair).
3. Distribute **What's Your Energy Need?** worksheets and discuss shaded box and diagram.
4. Calculate (number 1) student's basal metabolic rate, BMR, as a group activity. Explain BMR as the speed at which the body carries out the autonomic processes.
5. Display **Factors Affecting BMR** transparency and discuss the factors which can affect BMR.
6. Ask students to compare and contrast the BMR of a young child, a teenager, a middle-aged person, and an elderly person.
7. Explain that we also use energy to perform external physical activities like sitting, walking, running, and others.
8. Have students determine their usual activity level and complete number 2 on worksheet to estimate their total basal calories needed for physical activities.
9. Explain that the body even uses energy to digest the food we eat. We call this the specific dynamic effect (SDE).
10. Have students compute their SDE, number 3, on the worksheet.
11. Complete calculations to determine individual total daily energy output (number 4).
12. Display **Calorie Summary for the Life Cycle** transparency. Explain that a person's daily energy output varies from person to person, activity to activity, and day to day all throughout life.
13. Have students complete **How Do I Differ from Others?** section of worksheet.
14. Discuss results with students sharing descriptions and total energy needs for each of the five persons. Encourage a variety of results based on individual differences.

EXPECTED DATA:

Varies according to person or persons.

EVALUATION:

Completed in Steps 11 and 14 of procedure.

TEACHER NOTES:

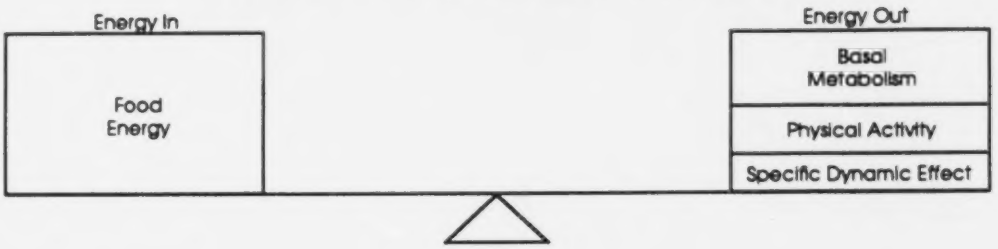
Emphasize the importance of knowing what a person's daily energy output is in order to determine how many food calories (energy) are needed for daily balance.

STATE GOALS:

BPS1-8-B1; BPS1-8-F4; BPS1-8-F1; BPS2-10-F2; BPS2-10-K1; BPS2-10-M4; BPS2-12-D3; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8-B2; LA2-8-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10,12-B1; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8-C2; LA4-8-D1; LA4-8-D2; LA6-8,10-C2; LA6-10-C1; PDH2-8-F1; PDH2-8-F4; PDH2-10-F2; PDH2-10-F3; PDH4-10,12-L1; PDH5-10-A1.

Courtesy of *Food for Today* and *Food Science and You*, Glencoe Publishing Company

WHAT'S YOUR ENERGY NEED?



How much energy do YOU need each day? Your body uses energy for everything it does: breathing, working, sleeping. Each unit of energy is called a calorie, and we get our calories from the food we eat. Complete the following chart, and you will have an estimate of how many calories you need to consume each day to provide the energy your body uses.

Directions:

1. Calculate your basal metabolic rate (BMR).
   a. Your weight in pounds _____ ÷ 2.2 = _____ kilogram weight
   b. Multiply kilogram weight by 22 for a female, 24 for a male.
      kilogram weight _____ X (22/24) _____ = calories for basal metabolism

2. Estimate total basal calories needed for physical activity.
   a. Multiply basal metabolism calories by the activity level percentage: 20% for sedentary, 30% for light, 40% for moderate, 50% for vigorous, and 50% for strenuous.

   b. Refer to **Calories Used For Activites** chart to determine activity level.
      Calories for basal metabolism _____ X Activity level percentage _____ % =
      _____ basal calories for physical activity

3. Compute specific dynamic effect (SDE).
   a. Physical activity calories = calories expended

   b. Multiply calories expended by 10%.
      Calories expended _____ X .10 = _____ calories for SDE

4. Combine figures for total energy output.
   a. Basal metabolism calories _____ + Physical activity calories _____ +
      SDE calories _____ = _____ total energy output

onclusion:
balance the _____ **calories** (energy) my body uses daily, I need _____ **calories** (energy)
om food.

SA-113

HOW DO I DIFFER FROM OTHERS?

CALORIES USED FOR ACTIVITIES

Type of Activity	Calories per hour
Sedentary Activites done while sitting, with little or no arm movement: reading; writting; eating; watching television or movies; sewing; playing cards.	80 to 100
Light Activities done while standing that require some arm movement, and strenuous activities done while sitting: preparing food; doing dishes; dusting; handwashing small articles of clothing; ironing; walking slowly; personal care; rapid typing; filing in an office.	110 to 180
Moderate Activities done while standing that require moderate arm movement and activites done while sitting that require vigorous arm movement: making beds, mopping, and scrubbing; sweeping; light polishing and waxing; laundering by machine; light gardening and carpentry work; walking moderately fast.	170 to 240
Vigorous Heavy scrubbing and waxing; handwashing large articles of clothing; hanging out clothes; walking fast; bowling; golfing; gardening.	250 to 350
Strenuous Swimming; tennis; running; bicycling; dancing; skiing; football.	350 or more

Changes in the basal metabolic rate and the type and amount of physical activity cause daily energy (calorie) needs to vary throughout an individual's life cycle. Determine the daily energy need for each of the following persons:

teenager working at a fast-food restaurant
professional sports player
elderly person confined to bed
middle-aged office worker
kindergarten child

Directions: Complete the following on a separate sheet of paper.

1. Write a complete description of each person including information which would affect their daily energy needs: age, gender, body size and weight, environment, and so on. Use a variety of resources to form your description. List the resources used.

2. Calculate each person's daily energy needs (i.e., basal calories + physical activity calories + SDE calories = total energy output). Show your work.

Conclusions:

Person	Daily Energy Need
teenager	
sports player	
elderly person	
middle-aged person	
kindergartner	

Courtesy of *Food for Today*, Glencoe Publishing Company

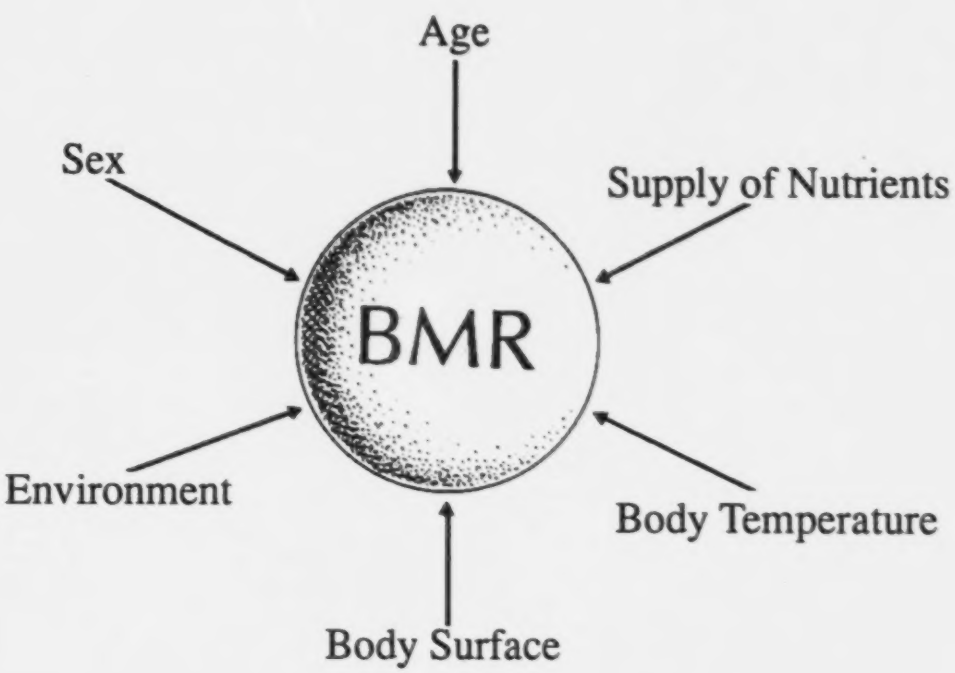
FACTORS AFFECTING BMR

BMR is higher

- in younger people
- for males
- for large people (more body surface area)
- in a cold environment
- during a fever (increased body temperature)

BMR is lower

- in older people
- for females
- for small people (less body surface area)
- in very hot weather
- when inadequate nutrients are consumed



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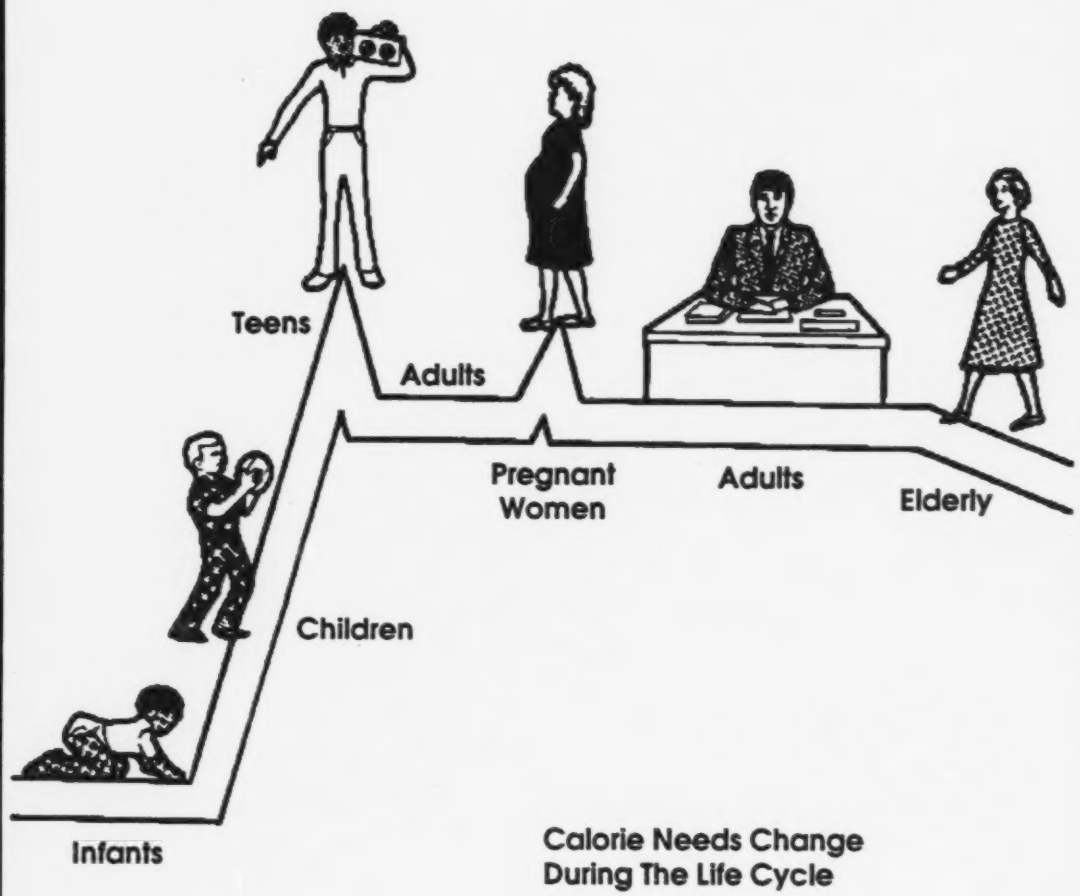
Transparency

CALORIE SUMMARY FOR THE LIFE CYCLE



Calorie Needs Change During The Life Cycle

SA-116

Courtesy of *Food for Today*, Glencoe Publishing Company

CALCULATING BY USING A BOMB CALORIMETER

OBJECTIVES:

Demonstrate that foods contain energy that is released when they are burned.
Construct a simple calorimeter.
Organize and manage human and material resources.

MATERIALS:

One copy of **Energy Content In Food** experiment worksheet per student
Per Lab Group:

Large can, 28 oz	Triple beam balance
Small can, 12 oz	100 mL graduated cylinder
Metal diffuser	Celsius thermometer
Stirring rod	Wooden matches
Large cork	Dry-roasted peanuts
Long needle	Walnut halves

PREPARATION:

1. Remove the top and bottom of the large (28 oz) cans using a can opener. Remove only the top of the smaller (12 oz) cans.
2. Using the pointed end of a bottle opener, cut approximately six triangles into the bottom sides of the larger cans. Cut two triangles opposite each other in the top side of the smaller cans.
3. Set up a sample calorimeter and a cork, needle, and nut assembly as models for the students.

PROCEDURE:

1. Introduce activity by asking, "Why do we eat?" Explain that food tastes good and makes us feel good, but we really eat because we need energy to stay alive. Energy comes in the form of food, and it can be measured in a heat unit called a calorie, or kilocalorie. A calorie represents the amount of heat needed to raise the temperature of one gram of water 1°C. Scientists use a method called calorimetry to measure the amount of energy found in food. In this experiment, you will construct a simple calorimeter to measure the calories in different food samples.
2. Divide class into lab groups of two students each and distribute **Energy Content In Foods** experiment worksheets.
3. Display a sample calorimeter assembly to serve as a model for students.
4. Demonstrate how to mount nut sample on the cork to prevent breakage.
5. Remind students to mass the cork, needle, and nut assembly as one unit before and after burning the sample.
6. Circulate throughout the room, offering assistance as students conduct experiment.
7. Assist students in making calculations. Remind them they are calculating calories per gram and will have to divide by 1000 to convert results to kilocalories, such as found in actual "calorie" charts.
8. Provide **USDA Nutritive Value of Foods** charts as reference materials.
9. Share students' results for comparison.

EXPECTED DATA:

This is only an example. Actual figures will vary.

Kind of Nut	Mass			Temperature			Calories	
	Original	Final	Change	Original	Final	Change	Per gram	Per Kilogram
Peanut	2.2g	1.4g	0.8g	27°C	44°C	17°C	2125	2.1
Walnut	2.9g	2.3g	0.6g	20°C	39°C	19°C	3167	3.1

1. Answers will vary. Sample calculation for the peanut would be as follows:
   100g x 17 x 1 calorie/degrees-gram = 1700 calories.
   Sample calculation for the walnut would be as follows:
   100g x 19 x 1 calorie/degrees-gram = 1900 calories.
2. Answers will vary. Sample calculation for the peanut would be as follows:
   1700 calories/.80g = 2125 calories = 2.1 kcal per gram.
   Sample calculation for the walnut would be as follows:
   1900 calories/.60g = 3167 calories = 3.1 kcal per gram.
3. Walnut. Peanut. Exact quantities will vary from the values in the standard calorie tables. Results should agree with relative table values (i.e., peanuts should have a lower value than walnuts).
4. The experimental values will be less than table values because the equipment assembly was not insulated to prevent energy loss to the surroundings.
5. Walnuts contain 40% more calories than peanuts.

EVALUATION:

Completed in Steps 6 through 9 of procedure.

TEACHER NOTES:

Other foods, such as marshmallows and popcorn, may be used for sampling. If time allows, students may repeat the experiment to reinforce the need for retesting for verifiable results.

STATE GOALS:

BPS1-8-B1; BPS1-8-C3; BPS1-8-D1; BPS1-8-D2; BPS1-8-F3; BPS1-8,10-F4; BPS1-8-F5; BPS1-8-F1; BPS1-8-L1; BPS1-10,12-F2; BPS1-10-L2; BPS1-12-D3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8,12-B3; BPS3-8-B1; BPS3-8-B5; BPS3-8-B6; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-B1; BPS4-8,10-C1; BPS4-8,10-E1; BPS4-8,10-F1; BPS4-8,10G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-10-J1; BPS4-10-L1; BPS4-10-M1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8,10,12-B2; LA2-8,10-C3; LA2-8,10,12-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10,12-B1; LA2-10-B3; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8,10-C2; LA4-8-D1; LA4-8-D2; LA4-10,12-E1; LA4-12-E2; M1-8-A1; M1-8-B1; M1-8-B4; M3-10,12-D2; M3-10-D3; M3-8,10-E1; M3-12-A1; M3-12-E1; M4-12-B1; M3-12-D1; M6-10,12-E1; M6-12-A1; M6-12-E2; M7-8,10,12-E1; M7-8,10,12-E2; M7-8,10-E3; M7-8,10E4; M7-8,10-E5; M7-8,10-E6; M7-8,10,12-G1; M7-8,10-G2; M7-12-H1; PDH6-10-J1; PDH6-12-J3.

Courtesy of *Food Science and You*, Merrill Publishing Company

ENERGY CONTENT IN FOODS

Experiment

You have been studying how food is converted into energy during metabolism. Sometimes it is difficult to imagine that a food can actually produce energy. In this experiment, you will burn nuts to see how much heat energy is released per gram of nut burned.

Materials:

- Long needle
- Large cork
- Dry-roasted peanuts
- Walnut halves
- Small can, 12 oz
- Large can, 28 oz
- Stirring rod
- Metal diffuser
- Triple beam balance
- 100 mL graduated cylinder
- Celsius thermometer

Procedure:

1. Stick the eye of a needle in the narrow end of a cork. Mount a nut sample on the point of the needle. The cork, nut, and needle are called the nut assembly.
2. Determine the mass of the nut assembly. Record it in your data table.
3. Assemble a simple calorimeter—insert a glass stirring rod through the holes in the sides of the small can. Use the glass rod to balance the small can within the large can.
4. Pour exactly 100 mL tap water into the small can. Take the temperature of the water in the can and record it in your data table.
5. Place the nut assembly on a metal diffuser and ignite it with a match. Immediately lower the large can around the nut assembly so the small water can is above the nut.
6. Allow the nut to burn for two minutes or until it goes out.
7. Stir the water with the thermometer. In your data table, record the water's highest temperature.
8. Mass the nut assembly and record it in your data table.
9. Repeat experiment using another kink of nut assembly and fresh water.

Calculations and Questions:

1. Calculate the calories of heat from each burning nut. The 100 mL of water has a mass of 100 g. Use the following equation to make the calculation:

   grams of H_2O X temperature change X 1 calorie/degrees - grams = Calories

2. Divide the calories from Question 1 by the change in mass of the nut. This determines the calories released per gram of nut burned. Record this value in your data table.
3. Which kind of nut released the most heat per gram? The least? Do these results agree with the information in standard calorie tables provided by your teacher?
4. Why do you suppose the calculated values for calories per gram are less than the values listed in the calorie table?
5. If you were dieting, which type of nut would be better for you to eat?

Sample Data Table

	Mass			Temperature			Calories	
Kind of Nut	Original	Final	Change	Original	Final	Change	Per Gram	Per Kilogram

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IDENTIFYING SOURCES AND NAMES OF FIBERS

OBJECTIVES:

Distinguish between natural and manufactured fibers by the burning test.
Identify fibers by observable chemical reactions during burning.
Demonstrate responsibility for carrying out activity.

MATERIALS:

One copy of Fiber Burning Test experiment worksheet per student
Per Lab Group:
- One yarn or fabric sample (3 x 3 cm square) of each of the following: cotton, wool, acetate, nylon, and olefin
- Forceps
- Candle and holder
- Aluminum foil or pie pan
- Matches

PREPARATION:

1. Collect yarn and fabric of 100% fiber content for each of the five materials.
2. Cut yarn into 3 cm lengths or fabric into 3 cm x 3 cm squares.
3. Attach yarn or fabric samples to cardboard squares and label with fiber name.

PROCEDURE:

1. Introduce activity by stating that scientists use a variety of tests to identify fibers. A preliminary test is the burning test which helps to divide fibers into categories. This experiment allows you to observe the chemical reactions which occur as fibers burn and to classify them by name as natural or manufactured fibers.
2. Divide class into lab groups of two students each.
3. Distribute **Fiber Burning Test** experiment worksheets and review directions.
4. Using a fabric sample, demonstrate how to unravel a yarn and untwist and fluff it for the experiment.
5. Demonstrate and explain what reactions may be observed as the fibers approach, enter, and are removed from the flame.
6. Describe probable odor and residue appearance.
7. Circulate among students as experiments are conducted.
8. Discuss results, answers to questions, and conclusions with class.

EXPECTED DATA:

Fibers	Rate of Burning and Afterglow	Odor	Residue
Natural Cotton	burns quickly, afterglow	burning paper	light, feathery, gray ash
Wool	burns slowly, self-extinguishing	burning hair	brittle, small black bead
Manufactured Acetate	burns rapidly, continues burning	acrid (hot vinegar)	irregular-shaped, hard, black bead
Nylon	burns slowly with melting, self-extinguishing	celery	hard, tough, gray or tan bead
Olefin	melts, burns slowly, continues to burn	chemical odor	hard, tough, tan bead

1. Wool
2. Residue is feathery ash for cotton and black bead for acetate. Odor is burning paper for cotton and hot vinegar for acetate.
3. All formed hard beads.
4. Olefin, nylon
5. Manufactured fibers formed hard bead residues. Natural fibers formed feathery ash residue or a black bead (wool). Wool is further distinguished from manufactured fibers by odor.
6. Only to classify as natural or manufactured fiber. Need other tests to be more specific.

EVALUATION:

Completed in Step 8 of procedure.

TEACHER NOTES:

It is important that the yarn and fabric samples be of 100% fiber content for test results to be accurate. Finishes and dyes may alter the flammability. Check labels before purchasing or remove finish before using.

STATE GOALS:

BPS1-8-B1; BPS1-8-F5; BPS1-8-F3; BPS1-8-L1; BPS1-8-P4; BPS1-10,12-F2; BPS1-10-F5; BPS1-10-L2; BPS1-12-C1; BPS1-12-D3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8-B1; BPS3-8,10-B3; BPS3-8-B6; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-B1; BPS4-8,10-C1; BPS4-8,10-D1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8, 10-H 1; BPS4-8,10-I1; BPS4-12-A.M.

Courtesy of *Essentials of Textiles*, Holt, Rinehart, and Winston

FIBER BURNING TEST

Experiment

The burning test is a good preliminary test for fiber identification. By observing the chemical reactions during burning, we can classify fibers into specific categories and predict performance and appropriate care.

Materials:

Forceps
Matches
Aluminum foil or pie pan
Candle and holder (or Bunsen burner)
Yarn or fabric samples:
cotton, wool, acetate, nylon, and olefin

Procedure:

1. Assemble candle and holder in an aluminum pie pan or over a piece of aluminum foil.
2. Obtain yarn or fabric samples and complete experiment with one fiber sample at a time.
3. Untwist a yarn so the fibers are in a loose mass.
4. Light candle or Bunsen burner.
5. Hold the loosened fibers in forceps and move them toward the flame from the side. Do not bring down into the flame.
6. Observe the reaction as fibers approach the flame. Do they start to burn, melt, or curl away?
7. Move fibers into the flame for one or two seconds and then pull out, observing reactions. Do they burn quickly or slowly? Is it a steady flame, sputtering flame, or no flame at all? When removed, do they continue to burn and flame or does it go out?
8. Notice any odor given off by the fibers during the burning or charring.
9. Observe the ash or residue formed. Is it brittle, bead-shaped, feathery, the shape of the yarn, or nearly no residue?
10. Record all observations in data table.
11. Repeat process for other fiber samples.

Questions:

1. Which of the natural fibers smelled like burning hair?
2. How could you distinguish cotton from acetate?
3. How were the manufactured fibers similar?
4. Which fibers would be safest in or near a fire?

Conclusions:

5. Based on your results, how would you distinguish a natural fiber from a manufactured fiber?
6. Is the burning test reliable for fiber identification? Why or why not?

Sample Data Table

Fibers	Rate of burning and afterglow	Odor	Residue
Natural Cotton			
Wool			
Manufactured Acetate			
Nylon			
Olefin			

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DISTINGUISHING FIBER PROPERTIES

OBJECTIVES:

Compare the physical and chemical properties of several common fibers.
Correlate fiber knowledge to make consumer clothing decisions.
Read and follow directions.
Demonstrate responsibility for carrying out activity.

MATERIALS:

One copy of **Fiber Tests** experiment worksheet for each student
Machine washer and dryer
Laundry detergent
Per Lab Group:
- Four 3" (8 cm) square fabric swatches of the following:
  cotton, silk, acetate, nylon, and acrylic
- Permanent marking pen
- Aluminum foil
- Red food coloring
- Dropper
- Balloon

PREPARATION:

1. Purchase yard goods for fabric test samples which are 100% fiber content and free of any finishes. Use only white or light-colored fabric.
2. Cut samples accurate to size to ensure correct test results.
3. In order to have a full load for laundering, one or two old white sheets can be added to the washer.

PROCEDURE:

1. Introduce activity by asking students to identify the fibers used to make different garments. Do you know how to care for that garment? Which must be dry cleaned? This experiment allows you to discover the properties of several common fibers which you buy and wear. Fiber properties determine the appearance, performance, and comfort of your garments.
2. Divide class into lab groups of two students each.
3. Distribute **Fiber Tests** experiment worksheet and review directions.
4. Remind students to conduct experiments in order given and to retain the control samples.
5. Collect shrinkage samples and do the laundering and drying processes.
6. Circulate throughout the lab to answer questions and give help as needed.
7. Have students discuss questions when finished.

EXPECTED DATA:

Name of Fiber	Test 1 Shrinkage	Test 2 Wrinkle	Test 3 Absorbency	Test 4 Static
Cotton	yes	5	good	good conductor
Silk	yes	3	good	poor conductor
Acetate	yes	4	moderate	poor conductor
Nylon	no	2	poor	poor conductor
Acrylic	no	1	poor	poor conductor

1. Cotton, silk
2. Cotton
3. Cotton
4. Helps consumer to determine performance and care maintenance of a garment when fiber content from the clothing label is known.

EVALUATION:

Have students read the fiber content labels of five different garments. In a written report, have students explain how the fibers used affect the appearance, performance, and comfort of each garment.

TEACHER NOTES:

For better comprehension, fiber tests should be conducted on fabrics currently being purchased by students.

STATE GOALS:

BPS1-8-B1; BPS1-8-P4; BPS1-10-F5; BPS1-12-C1; BPS2-10-E3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8-B1; BPS3-8,10-B3; BPS3-8-B6; BPS3-12-A.B; BPS4-8,10-B1; BPS4-8,10-C1; BPS4-8,10-D; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8,10,12-B2; LA2-10,12-B1; LA2-8-C3; LA2-8,10,12-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10,12-A1; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8-C2; LA4-8-D1; LA4-8-D2; LA6-8-A1; LA6-8,10-C2; LA6-10-C1.

FIBER TESTS

Experiment

Fiber properties determine the appearance, performance, and comfort of your garments. This experiment allows you to observe how fibers react and respond to a variety of tests. The results will help you make wise decisions when buying garments.

Materials:

- Permanent marking pen
- Aluminum foil
- Dropper
- Balloon
- Machine washer and dryer
- Red food coloring
- Four 3 inch (8 cm) square swatches of the following: cotton, silk, acetate, nylon, and acrylic

Procedure:

1. Use a permament marker to label each fabric swatch with the letter representing its fiber content, the number of the test, and your initials. Save one swatch of each fabric for a control.
2. Complete each test as directed and record results in data table.
3. Shrinkage test (1)
   a. Launder a sample of each fabric using normal agitation, warm/hot water, and detergent.
   b. Dry samples at a medium to high heat setting.
   c. Compare samples with controls.
   d. Determine and record whether any change in size or shape.
4. Wrinkle test (2)
   a. Crush fabrics in the hand for a total of three minutes. Reshuffle the fabrics after the first minute and again after the second minute.
   b. Spread the fabrics out on the table as quickly as possible. Wait three minutes. Compare fabric with controls and rank, using 1 for the fabric with the least wrinkles, 2 for the next less wrinkled, and so on.
5. Absorbency test (3)
   a. Place swatches on a piece of aluminum foil.
   b. Using a dropper, put a drop of food coloring the center of each swatch.
   c. Notice the length of time that it takes each fabric to absorb the food coloring.
   d. Record whether the fabric has good absorbency or poor absorbency.
6. Static test (4)
   a. Reuse swatches from wrinkle test.
   b. Blow up and tie a balloon.
   c. Rub inflated balloon on someone's hair.
   d. Check a sample of each fabric for static cling by touching it to the balloon.
   e. Record on data table whether fabric has good electrical conductivity (does not create static electricity) or poor electrical conductivity (produces static electricity).

Questions:

1. Which fiber/s were the most absorbent?
2. Which fiber/s did not produce static electricity?
3. Which fiber/s would be the most comfortable to wear in hot weather?

Conclusion:

4. How does knowledge of a fiber's properties help a consumer make wise decisions when buying garments?

Courtesy of *Textiles and Clothing*, Indiana Curriculum Guide

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FIBER TESTS

Experiment (contined)

Sample Data Table

Name of Fiber	Test 1 Shrinkage	Test 2 Wrinkle	Test 3 Absorbency	Test 4 Static
Cotton				
Silk				
Acetate				
Nylon				
Acrylic				

Courtesy of *Textiles and Clothing*, Indiana Curriculum Guide

DIFFERENTIATING THE ADVANTAGES AND DISADVANTAGES OF FIBER PROPERTIES

OBJECTIVES:

Distinguish the properties and characteristics of natural and manufactured fibers.
Predict fiber performance and care based on fiber identification.
Identify where to locate and how to use information.

MATERIALS:

One copy of **Natural Fibers** and **Manufactured Fibers** worksheets per student
Variety of resource references on textile properties and characteristics
One copy of **Name that Fiber** worksheet per student

PREPARATION:

None

PROCEDURE:

1. Introduce activity by pointing out various pieces of clothing worn by the students or yourself and asking the following questions:
   a. What is the fabric content of this garment?
   b. Does the fabric content make a difference in performance and care?
   c. Would you launder or dry clean the garment?
2. Explain that the fiber content of our clothing determines how it feels, how well it wears, and how we should care for it. This activity allows you to research the properties and characteristics of natural and manufactured fibers to determine the effect each has upon you.
3. Distribute **Natural Fibers** and **Manufactured Fibers** worksheets for students to complete using available resource references.
4. Discuss researched information and questions.
5. Distribute **Name that Fiber** worksheet.
6. Discuss answers upon completion.

EXPECTED DATA:

Natural Fibers

1. cotton, linen
2. wool
3. linen, wool, silk
4. cotton, linen, wool, silk
5. silk
6. ramie

Manufactured Fibers

1. nylon
2. spandex
3. rayon, acetate
4. all of them
5. olefin

Matching:

Part I

1. C
2. D
3. A
4. B

Part II

5. F
6. B
7. D
8. E
9. G
10. A
11. C

Part III

12. A
13. C
14. C
15. A, C
16. C
17. B
18. A
19. C
20. C

Multiple Choice:

21. A
22. B
23. B
24. C
25. C
26. B
27. A
28. A
29. C

EVALUATION:

Completed in Steps 4 and 6 of procedure.

TEACHER NOTES:

Provide as many references as possible to encourage researching from a variety of sources, not just the first one selected.

STATE GOALS:

BPS1-8-B1; BPS1-8-P4; BPS1-10-F5; BPS1-12-C1; BPS4-8,10-B1; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12,-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8,10,12-B2; LA2-10,12-B1; LA2-8-C3; LA2-8,10,12-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10,12-A1; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8-C2; LA4-8-D1; LA4-8-D2; LA6-8-A1; LA6-8,10-C2; LA6-10-C1.

NATURAL FIBERS

Worksheet

Directions: Using available resource references, summarize important information about natural fibers in the chart below. Answer the questions after completing the chart.

Fiber	Fiber Source	Properties and Characteristics	Cleaning and Storage	Common Uses
Cotton				
Linen				
Ramie				
Wool				
Silk				

Questions:

1. Which two natural fibers tend to wrinkle easily?
2. Which natural fiber is often damaged by moths?
3. Which natural fibers generally require dry cleaning?
4. Which natural fibers are damaged by sunlight?
5. Which natural fiber has the highest luster and lowest density?
6. Which natural fiber has the greatest strength?

MANUFACTURED FIBERS

Worksheet

Directions: Using available resource references, summarize important information about manufactured fibers in the chart below. Answer the questions after completing the chart.

Name	Properties and Characteristics	Cleaning and Storage	Common Uses
Rayon			
Acetate			
Nylon			
Spandex			
Polyester			
Acrylic, Modacrylic			
Olefin			

Questions

1. Which manufactured fiber is the strongest?
2. Which manufactured fiber had the highest elasticity?
3. Which manufactured fibers begin from substances found in nature?
4. Which manufactured fibers are sensitive to high temperatures?
5. Which manufactured fibers have very low densities?

Courtesy of *Textiles and Clothing*, Indiana Curriculum Guide

NAME THAT FIBER

Worksheet

Matching: Part I

Natural Fibers:
A. Wool
B. Cotton
C. Linen
D. Silk

____ 1. Plant fiber that is used to make summer suits, tablecloths, and napkins.
____ 2. Smooth, shiny fiber gathered from an insect's cocoon and used to make blouses and ties.
____ 3. Warm, wrinkle-resistant fiber made from the hair of sheep that is used to make blankets and coats.
____ 4. Absorbent, comfortable plant fiber that is often used to make towels and sheets.

Matching: Part II

Manufactued Fibers:
A. Acrylic
B. Polyester
C. Rayon
D. Spandex
E. Nylon
F. Acetate
G. Olefin

____ 5. Nail polish remover containing acetone will damage this fiber that is often found in coat linings.
____ 6. Wrinkle-resistant fiber that is commonly combined with cotton in skirts, slacks, jackets, and many other garments.
____ 7. This fiber's high stretch and recovery make it ideal for swimwear.
____ 8. Lightweight and very strong fiber that is used to make pantyhose and carpeting.
____ 9. Waxy feeling fiber that is used to make carpeting and upholstery.
____ 10. This warm feeling fiber is used to make machine washable sweaters and blankets.
____ 11. This first manufactued fiber is chemically produced from cellulose and is used to make fabrics with a silky look and feel.

Matching: Part III

____ 12. Silk
____ 13. Nylon
____ 14. Rayon
____ 15. Linen
____ 16. Acetate
____ 17. Cotton
____ 18. Wool
____ 19. Acrylic
____ 20. Polyester

Fiber Care:
A. Dry cleaning is generally recommended.
B. Machine wash and dry (or dry clean)—temperatures may be hot
C. Machine wash and dry at warm temperatures (or dry clean)—high temperatures can cause damage

Multiple Choice

____ 21. Silk, spandex, and wool all _____.
A. are damaged by bleach B. have poor elasticity C. melt at high temperatures
____ 22. Oily stains are most difficult to remove from _____.
A. cotton B. polyester C. rayon
____ 23. Strong acids especially damage _____.
A. acrylic and polyester B. linen and cotton C. wool and silk
____ 24. Static build-up is not a problem in fabrics made of _____.
A. acrylic B. nylon C. cotton
____ 25. Chlorine salts (in deodorant and water) especially damage silk and _____.
A. polyester B. nylon C. spandex
____ 26. The strength of _____ increases when the fiber is wet.
A. rayon B. cotton C. wool
____ 27. Sunlight does not greatly damage _____.
A. polyester B. silk C. acetate
____ 28. The ability of a fiber to stretch and recover to its original dimension is _____.
A. elasticity B. resiliency C. flexibility
____ 29. _____ is the ability of fibers to cling together.
A. absorbency B. density C. spinnability

ACKNOWLEDGING THE PROPERTIES OF HEAT ENERGY

OBJECTIVES:

Interpret the properties of heat energy.
Identify where to locate and how to use information.

MATERIALS:

Heat Produces Molecular Motion transparency
Energy Changes with Changes of State transparency
Kinds of Heat Transfer transparency
Wax-coated paper cup
One copy of **Magic Square** worksheet for each student

PREPARATION:

None

PROCEDURE:

1. Introduce the activity by asking what allows us to do work? Explain that it is the flow of energy within each person. Sometimes energy is absorbed and sometimes it is released. There are many kinds of energy, but we're going to study heat energy and how its properties affect us.
2. Discuss the properties of heat energy by using the three transparencies and information from content outline (II G 1 a - j).
3. Demonstrate a phase change.
   a. Fill a wax-coated paper cup with water.
   b. Heat it directly on the stove until the water boils.
   c. Observe water and cup.
      1) Explain that as long as there is water in the cup and the temperature of the cup and water remain at 100°C, the cup will not burn.
      2) Conclude that this occurs because the heat energy is transferred to the water to keep it boiling.
4. Distribute **Magic Square** worksheet.
5. Discuss student responses and provide correct answers.

EXPECTED DATA:

A. 1	D. 5	G. 9
B. 6	E. 7	H. 2
C. 8	F. 3	I. 4

Magic number is 15.

When ice melts, energy from the surrounding air or other substances flows into the ice. This energy causes the ice molecules to vibrate faster (increased molecular motion) which, in turn, causes them to break out of their crystal structure. As the crystal structure falls apart, the solid ice becomes liquid water. During this process, the temperature of the ice and water remains constant at 0°C.

EVALUATION:

Completed in Step 5 of procedure.

TEACHER NOTES:

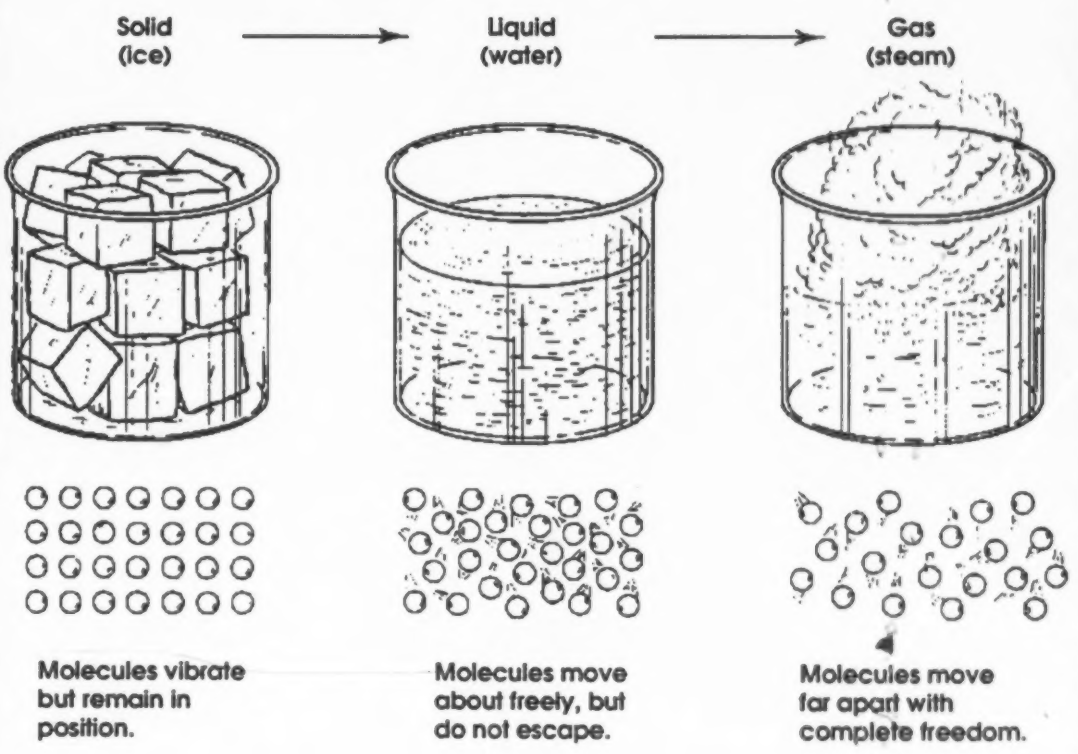
This activity provides the basics for understanding molecular motion and how heat energy effects physical and chemical changes. Application to food preparation, textiles and apparel, housing, and appliances and equipment will be covered in later activities.

STATE GOALS:

BPS1-8-B1; BPS1-8-D2; BPS1-8-F3; BPS1-8-F4; BPS1-8-F5; BPS1-8-L1; BPS1-10-F2; BPS1-10-L2; BPS1-12-C1; BPS2-12-D3; BPS2-12-F2; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8-B2; LA2-8-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10,12-B1; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8-C2; LA4-8-D1; LA4-8-D2; LA6-8,10-C2; LA6-10-C1; M1-8-A1; M1-8-B3; M1-8-B4; M1-12-E1; M3-8,10,12-E1; M4-12-D1; M7-8,10,12-E1; M7-8,10-E2; M7-8,10-E3; M7-8,10-E4; M7-8,10-E5; M7-8,10-E6; M7-8,10,12-G1; M7-12-H1.

Courtesy of *Food Science and You*, Glencoe Publishing Company

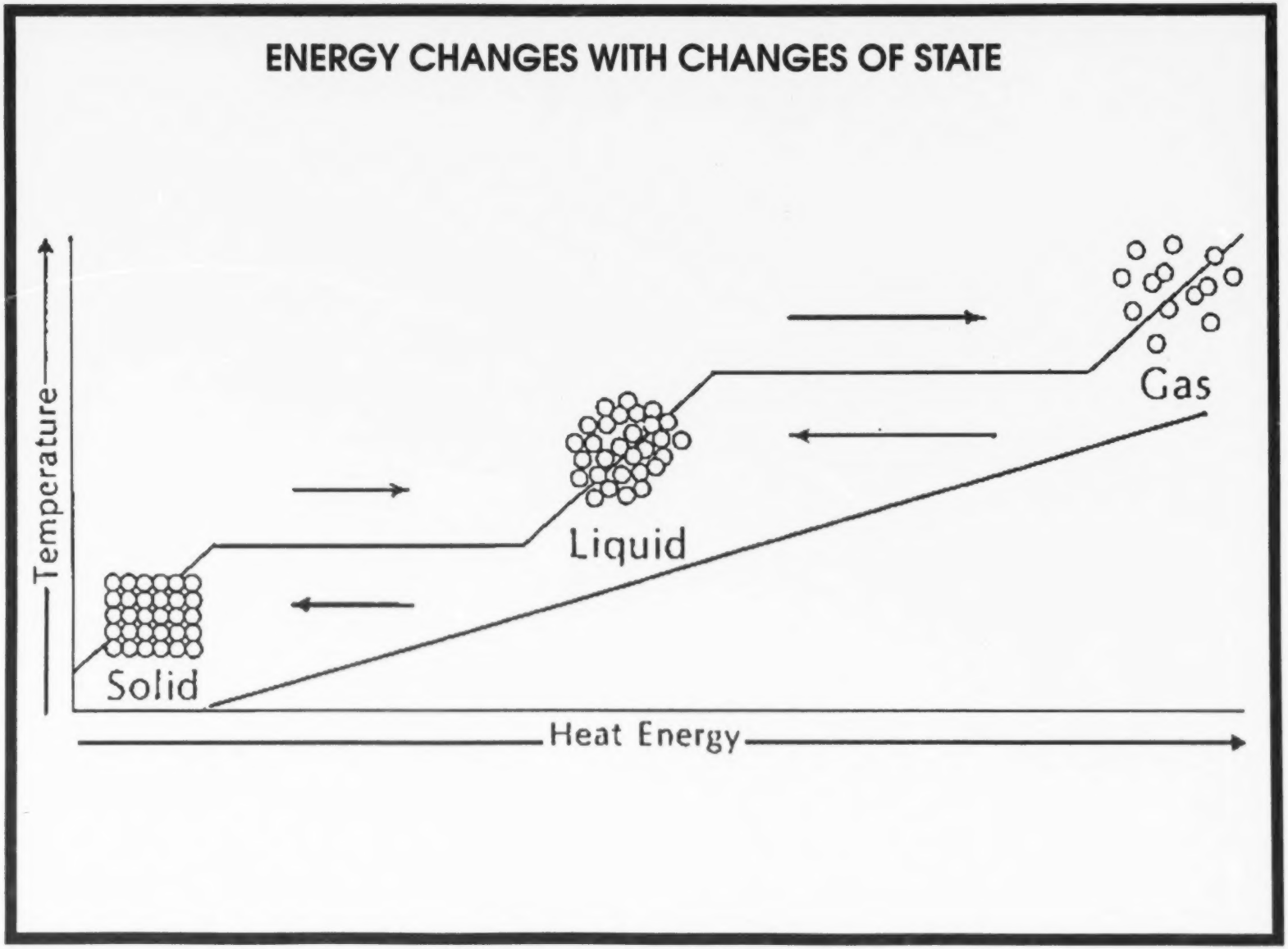
HEAT PRODUCES MOLECULAR MOTION



Courtesy of *Foundations of Food Preparation*, Macmillan Publishing Company SA-137

SA-138

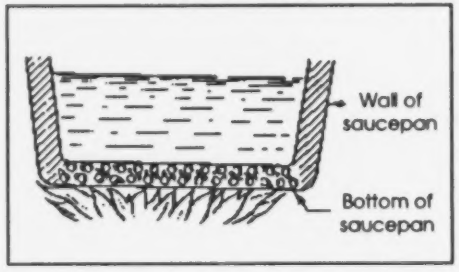
ENERGY CHANGES WITH CHANGES OF STATE



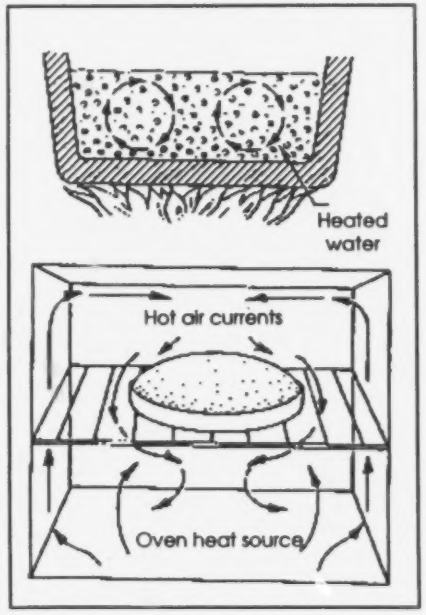
Courtesy of *Foundations of Food Preparation*, Macmillan Publishing Co.

KINDS OF HEAT TRANSFER

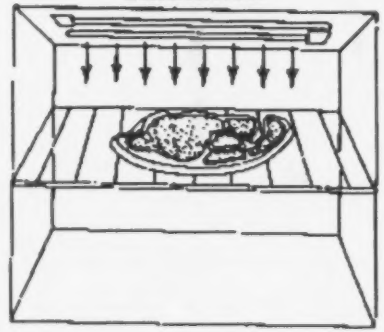
Conduction



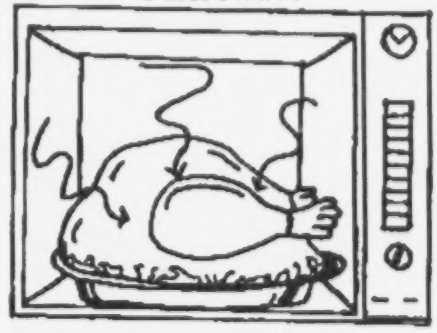
Convection



Radiation



Microwave



SA-139

Courtesy of *Foundations of Food Preparation*, Macmillan Publishing Co.

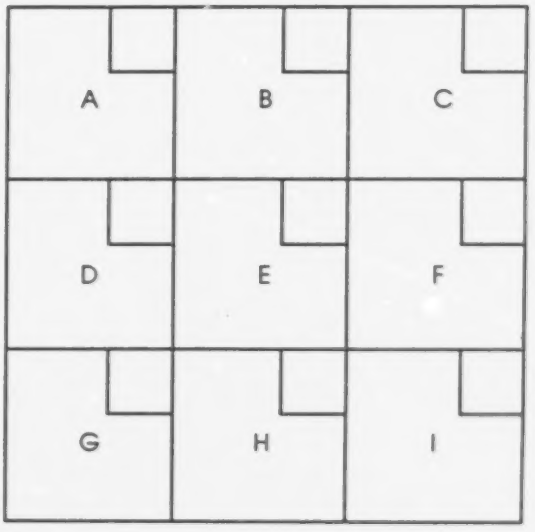
MAGIC SQUARE

Worksheet

Directions: Find the definition which best describes each term. Write the number of the correct definition in the space in each lettered square. If all your answers are correct, the total of the numbers, or the "Magic Number," will be the same in each row across and down. Write the Magic Number in the space provided.

Terms:

A. calorie
B. microwaves
C. temperature
D. latent heat
E. specific heat
F. absolute zero
G. conduction
H. heat
I. convention



The Magic Number is _____ .

Definitions:

1. The energy needed to raise the temperature of 1 g water 1°C.
2. The type of energy of most interest in food science.
3. The absence of all molecular motion.
4. The movement of energy through the motion of fluids or gases.
5. The energy stored in molecules during a phase change.
6. The type of energy that has the greatest affect on water molecules.
7. The amount of energy needed to raise the temperature of 1 g of a substance 1°C.
8. A measure of molecular motion.
9. The transfer of energy from particle to particle through molecular collisions.
10. The ability to do work.

Directions: Use complete sentences to answer the following question in paragraph form. Write your answer in the space below or on a separate piece of paper.

Describe the flow of energy, molecular motion, and temperature changes that occur when ice melts.

Courtesy of *Food Science and You*, Glencoe Publishing Company

DETERMINING THE EFFECT OF TEMPERATURE ON COOKING RATE

OBJECTIVES:

Compare the effect of temperatures on the rate of cooking.
Correlate the relationship between temperature and molecular motion.
Demonstrate responsibility for carrying out an activity.

MATERIALS:

One copy of **Effect of Temperature on Cooking Rate** experiment worksheet for each student
Two 400 mL beakers
Hot and cold water
Blue food coloring
Per Lab Group:

- Ring stand
- Utility clamp
- One-hole stopper
- Celsius thermometer
- Petroleum jelly
- Potato half
- Paring knife
- 100 mL graduated cylinder
- 400 mL beaker
- Wooden toothpicks
- Metal diffusers
- 2.5 cm square card template

PREPARATION:

1. To serve as a model for students, assemble a ring stand and utility clamp with a one-hole stopper holding a thermometer.
2. Cut a 2.5 cm square from index cards for each lab group.
3. Prepare raw potato cubes, ones that are partially cooked, and ones that are fully cooked, for students to examine for degrees of doneness. This will help students distinguish when the potato cubes are fully cooked and standardize experiment results.

PROCEDURE:

1. Introduce activity by explaining that we can't see individual molecules moving in a glass of water, but we can conduct a simple demonstration to show the result of their motion visually.
2. Demonstrate molecular motion by doing the following:
   a. Fill a 400 mL beaker about 2/3 full with room-temperature water.
   b. Place one drop of blue food coloring onto the surface.
   c. Watch what happens to the coloring in two to three minutes.
   d. Explain that the motion of the water molecules causes a mixing of the food coloring with the water.
   e. Pour out the colored water mixture and rinse thoroughly.
3. Have students form a hypothesis as to the effect of hot versus cold water upon the rate of mixing of food coloring.
4. Continue demonstration.
   a. Fill one 400 mL beaker about 2/3 full with ice cold water and another with hot tap water.
   b. Place the two containers side by side.
   c. Add one drop of blue food coloring to each beaker.

d. Watch the food coloring spread out in both containers.
e. Compare the mixing rate in the two containers.
f. Ask students in which container (hot or cold) did the mixing appear faster? (hot)

5. Explain the results on the basis of molecular motion. The hot water causes the water molecules to move faster and with greater force to spread the food coloring than do the water molecules in the cold water. In cooking food, heat energy causes the molecules to move faster and with greater force, causing the chemical reactions which change the food's composition. This experiment will demonstrate the effect of temperature upon molecular motion and the rate of cooking.
6. Divide class into lab groups of two students each.
7. Distribute **Effect of Temperature on Cooking Rate** experiment worksheets.
8. Demonstrate ring stand assembly and how to insert thermometer into a one-hole stopper using lubricant to prevent breakage.
9. Assign half of the lab groups Variation 1 and half Variation 2.
10. Pass around samples of partially cooked and fully cooked potato cubes so that students can get a feel for the ease with which toothpicks will penetrate potatoes at each of these degrees of doneness.
11. Demonstrate how to cut a 2.5 cm potato cube using cardboard template.
12. Cut potatoes in half and distribute one half to each lab group.
13. Circulate throughout the lab while students conduct experiment.
14. Have students place their data on the chalkboard so that an average can be calculated for the time required to fully cook the cubes at each temperature.
15. Discuss students' results.

EXPECTED DATA:

The hotter the temperature, the greater the rate of molecular action. In 90°C water, the potato cube should be completely done in 10.5 minutes. In 100°C water, the potato cube should be completely done in eight minutes.

1. Answered from data table and class data.
2. Depends on class data.
3. Depends on class data.
4. The higher temperatures caused an increased rate of chemical reaction. That is, the potato cooked faster.

EVALUATION:

Completed in Step 15 of procedure.

TEACHER NOTES:

This experiment also demonstrates heat energy transfer by convection and conduction. The convection currents of the boiling water transfer heat to the surface of the potato. The heat is then transferred to the interior of the potato by conduction. The higher the temperature, the faster the rate of heat transfer and, thus, cooking time for the food. Since temperature increases the rate of reactions, lowering the temperature will slow molecular motion. That is why when food is stored in a refrigerator or freezer, bacterial growth reactions causing food spoilage are inhibited or slowed down.

STATE GOALS:

BPS1-8-F4; BPS1-8-F5; BPS1-8-L1; BPS1-8-P4; BPS1-10-F2; BPS1-10-F4; BPS1-10-J4; BPS1-10-L2; BPS1-12-D3; BPS1-12-F2; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-10-B2; BPS3-8-A5; BPS3-8,10-B3; BPS3-8-B5; BPS3-8-B6; BPS3-8-B1; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-C1; BPS4-8,10-D1; BPS4-8,10-E1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-8-M1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8-C3; LA2-8,10,12-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10,12-B1; LA2-10-B2; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8,10-C2; LA4-8-D1; LA4-8-D2; LA4-8,12-E2; LA4-10,12-E1; M3-10,12-D2; M3-10-D3; M3-8,10-E1; M3-12-A1; M3-12-E1; M3-12-A1; M6-12-E2; M6-12-E6.

EFFECT OF TEMPERATURE ON COOKING RATE

Experiment

Heat energy causes the molecules within a substance to move faster. The faster they move, the greater the force with which they collide with one another thus causing chemical reactions to take place. Chemical reactions are necessary to change food's composition during cooking. This experiment demonstrates the effect of temperature on the rate of chemical reactions to cook potatoes.

Materials:

Ring stand
One-hole stopper
Metal diffuser
400 mL beaker
Paring knife
Wooden toothpicks
Utility clamp
Celsius thermometer
100 mL graduated cylinder
Potato
2.5 cm square card template

Procedure:

1. Assemble ring stand and utility clamp according to sample model.
2. Insert thermometer into one-hole stopper using lubricant to prevent breakage.
3. Attach stopper to clamp and support with bulb slightly above the bottom of the beaker set beneath.
4. Measure 200 mL water, using the 100 mL graduated cylinder. Pour the water into a 400 mL beaker. The water should be deep enough to immerse completely the cube of potato, although the potato is not added until later.
5. Obtain a potato and cardboard template from supply table. From the potato, cut a cube 2.5 cm on each side.
6. Follow the variation assigned by the teacher.
   a. **Variation 1:** Heat the water to 90°C.
   b. **Variation 2:** Heat the water to 100°C.
7. Monitor the water temperature, removing the beaker or turning down the heat as necessary to keep the temperature constant.
8. When you can keep the water temperature constant, immerse the piece of potato in the water.
9. Cook the potato, testing it every two minutes with a wooden toothpick. Based on how easily the toothpick punctures the potato, determine its degree of doneness, either uncooked, slightly cooked, or cooked. Record each test on the data table.
10. When the toothpick punctures the potato easily, note the time on the data table. Turn off the heat and remove the beaker from the stove.
11. On the chalkboard, record your variation number and the time needed to cook the potato.

Calculations and Questions:

1. List the times required to cook each of the potato cubes that were in the 90°C water. Make a similar list of the times required to cook each of the potato cubes that were in 100°C water.
2. Determine the average cooking time for the potato cubes in the 90°C water and the average cooking time for the potato cubes in the 100°C water.
3. How much difference was there between the average cooking times at the two temperatures?
4. Explain the differences in cooking time.

Sample Data Table

Water Temperaure:_____ °C	
Time in Minutes	**Degree of Doneness**

Courtesy of *Food Science and You*, Glencoe Publishing Company

SA-145

FORMULATING MAINTENANCE AND CARE GUIDELINES

OBJECTIVES:

Interpret clothing care labels.
Predict effect of maintenance upon fiber characteristics.
Identify where to locate and how to use information.

MATERIALS:

One copy of **Sweater Switch** worksheet for each student
Resource materials on fiber characteristics and care

PREPARATION:

Obtain or prepare clothing samples illustrating improper care maintenance (due to heat), such as shrunken slacks or scorched shirt.

PROCEDURE:

1. Introduce activity by displaying clothing items which have been ruined by misuse of heat during maintenance. Ask students to speculate about what caused the damage. Explain that heat has varying effects on fibers. Being aware of fiber characteristics can help you take care of your clothing and prevent costly mistakes like these.
2. Distribute **Sweater Switch** worksheet and review directions.
3. Provide resource materials on fiber characteristics and care maintenance.
4. Have students share results upon completion.

EXPECTED DATA:

Sweater 1

Label B – The warm temperatures and agitation in the washer along with the heat and tumbling in the dryer may damage the delicate sweater. The sweater might fade, stretch or shrink, and the lace collar might also tear or shrink.

Label C – Dry cleaning will not likely damage this sweater since the label does not warn against it, but it will add extra expense.

Sweater 2

Label A – Hand washing in cold water should not damage this sweater, but it is far more convenient to machine wash and dry. The heat of the dryer will also help remove wrinkles if the sweater is not overdried.

Label C – Dry cleaning this sweater is an unnecessary expense, but since the label does not caution against dry cleaning, no damage should result.

Sweater 3

Label A – Hand washing in cold water may safely clean this sweater, but dry cleaning is the only recommended method of care.

Label B – Machine washing and drying will very likely cause this sweater to felt (a type of permanent shrinkage in wool). Fading may be an additional consequence.

EVALUATION:

Completed in Step 4 of procedure.

TEACHER NOTES:

Excellent clothing samples may be purchased very inexpensively at thrift or second-hand stores and then treated (ruined) by the teacher.

STATE GOALS:

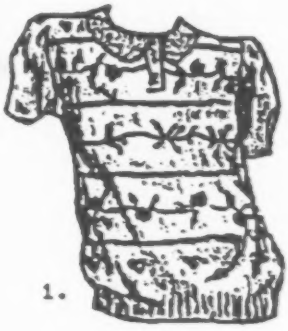
BPS1-8-F5; BPS1-8-P4; BPS1-12-D3; BPS1-12-F2; BPS2-10-E3; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8-C2; LA4-8-D1; LA4-8-D2.

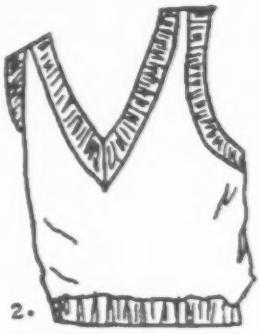
Courtesy of *Textiles and Clothing*, Indiana Curriculum Guide

SWEATER SWITCH

Worksheet

Imagine what might happen if all the care labels in your clothing were removed and you no longer knew the proper care instructions for each garment. The consequences would certainly be confusing and also costly since many fibers and fabrics can be damaged beyond repair if not cared for correctly. Below are three different sweaters, each with its own specific set of care instructions. With proper care, all three sweaters should wear well and remain attractive. But what might happen if each sweater received different treatment?





A.
100% Cotton
Hand or machine
wash separately,
cold water

B.
100% Acrylic
Machine wash warm
Tumble dry
Remove promptly

C.
100% Wool
Dry clean only

Directions: In the chart below, predict the outcomes of a care-label switch. Describe how each sweater might look and feel if it received the care recommended for the other two sweaters. Use appropriate resources to justify your answers.

CONSEQUENCES OF IMPROPER CARE

	Label A	Label B	Label C
Sweater 1.	Recommended Care		
Sweater 2.		Recommended Care	
Sweater 3.			Recommended Care

Courtesy of *Textiles and Clothing*, Indiana Curriculum Guide SA-149

TRANSFERING HEAT AWAY FROM OR TOWARD THE BODY

OBJECTIVES:

Determine the effect of color upon the transfer of heat.
Demonstrate responsibility for carrying out an activity.

MATERIALS:

One copy of **What Color Absorbs the Sun's Heat Best?** experiment worksheet per student
Per lab group
- One 4 cm x 4 cm square of white, black, red, blue, and green construction paper
- Five plastic bags (sandwich size)
- Five ice cubes, uniform size
- 10 mL graduated cylinder
- Serving tray or cookie sheet

PREPARATION:

1. Cut squares of construction paper ahead of time.
2. Locate a sunny location for samples.
3. Borrow trays from cafeteria if not available in lab units.

PROCEDURE:

1. Introduce activity by displaying two T-shirts: one white, the other black. Ask students which one they would prefer to wear outdoors on a hot summer day. Why? This activity demonstrates the effect of color upon the transfer of heat.
2. Divide class into lab groups of two students each.
3. Distribute experiment worksheet and review directions.
4. During waiting period, discuss how heat is transferred in textiles and apparel, using information in the content outline (II G 3 c 1)-4)).
5. Upon completion, discuss and compare students' results and conclusions.

EXPECTED DATA:

1 to 4. Amounts of water collected will vary, depending on amount of sunlight. In general, black absorbs the most heat and melts the ice the quickest; white absorbs the least heat and melts the ice the slowest.
Rank: Black, red, blue, green, and white.

5. Dark colors.
6. Color of car and its interior and color of house's paint, siding, and shingles have effect upon the amount of energy necessary to heat or cool the interior of the object.

EVALUATION:

Completed in Step 5 of procedure.

TEACHER NOTES:

Help students transfer the effect of color and heat energy to other areas: children's outdoor toys, lawn furniture, window displays, sports uniforms and others.

STATE GOALS:

BPS1-8-F4; BPS1-8-F5; BPS1-8-P4; BPS1-10-F2; BPS1-10-J4; BPS1-10-L2; BPS1-12-D3; BPS1-12-F2; BPS2-10-E3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-10-B2; BPS 3-8-A5; BPS3-8,10-B3; BPS3-8-B5; BPS3-8-B6; BPS3-8-B1; BPS3-12-A.B; BPS4-8, 10-A1; BPS4-8,10-C1; BPS4-8,10-D1; BPS4-8,10-E1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-8-M1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8-C3; LA2-8,10,12-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA2-10,12-B1; LA2-10-B2; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA3-8,10,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8,10-C2; LA4-8-D1; LA4-8-D2; LA4-8,12-E2; LA4-10,12-E1; M6-12-A1; M6-12-E2; M6-12-E6.

Courtesy of *Science Activities in Energy*, Solar Energy

WHAT COLOR ABSORBS THE SUN'S HEAT BEST?

Experiment

The color of our clothing affects us both pyschologically and physically. We may have a favorite color, but whether it keeps us physically warm or cool depends upon how well that color transfers heat energy.

Materials:

4 x 4" square of white, black, red, blue, and green construction paper
5 plastic bags (sandwich size)
5 ice cubes, uniform size
10 mL graduated cylinder
Serving tray or cookie sheet

Procedure:

1. Put a different-colored piece of construction paper in each plastic bag.
2. Arrange bags on tray so that they do not overlap.
3. Place an ice cube on top of each piece of construction paper inside the bag. Seal bag.
4. Set tray of samples in a sunny place.
5. Observe which ice cube melts first.
6. Write hypothesis of what you expect to happen.
7. After twenty minutes, measure the amount of water collected in each bag. Record information in data table.
8. Rank the colors of paper according to how well they conducted heat and melted the ice cube. Use number one for best conductor (most water formed) through number five for worst conductor (least water formed).

Questions:

1. In which bag did the ice cube melt first?
2. Which bag had the most water after twenty minutes?
3. Which color conducted the most heat?
4. Which color conducted the least heat?

Conclusion:

5. What color would be best to wear for comfort when outdoors in a cold climate?
6. How would you apply this knowledge of color and heat transfer to other objects in your daily life?

Sample Data Table

Color of Paper	Amount of Water Collected	Rank of Conduction

Courtesy of *Science Activities in Energy*, Solar Energy

EXPRESSING THE STRENGTH OF SUBSTANCES BY pH VALUE

OBJECTIVES:

Interpret the pH scale.
Identify pH values of common substances.
Demonstrate responsibility for carrying out activity.

MATERIALS:

Hydrogen and Hydroxide Ion Concentration transparency
One copy of **The pH of Common Substances** experiment worksheet for each student
Per Lab Group:
- Fourteen test tubes
- Test tube rack
- Marking pen
- pH indicator paper 1 to 11 range

Supply Table:
- Deionized water
- White vinegar (5% acetic acid)
- Sodium bicarbonate (baking soda)
- Six egg whites
- Honey
- Molasses
- Buttermilk
- Cream of tartar
- Lemon-lime soda
- Cranberry-apple juice
- Milk
- Powdered orange drink
- Lemon juice

PREPARATION:

1. Obtain deionized water from the science department or purchase distilled water at grocery or drugstore.
2. Mix powdered orange drink in advance. One 250 mL serving will be enough for all lab groups.
3. Use paper cups if there are not enough test tubes available.
4. Have the known solutions in beakers or flasks for easy dispensing. Label solutions with name and number to correspond with data table.

PROCEDURE:

1. Introduce activity by displaying a beaker filled with a clear solution. Have students guess the identity. Explain that a liquid can be an acid, a base, or neutral, depending upon the ion concentration of the solution.
2. Display **Hydrogen and Hydroxide Ion Concentration** transparency to show how acid solutions have a high concentration of hydrogen ions while basic, or alkaline, solutions have a higher concentration of hydroxide ions. Since we cannot determine the ion concentration of a solution by mere observation, scientists formulated a pH scale.
3. Explain how to interpret the pH scale using information from content outline (II H 2 a 1)-7)).
4. Divide class into lab groups of four students each.
5. Distribute **The pH of Common Substances** experiment worksheets.
6. Demonstrate how to use and read pH indicator paper.
7. Remind students to save test tubes 3 and 4 to combine in Step 3. Stress the importance of thoroughly mixing solutions in Step 3 before testing the pH.
8. Circulate throughout the lab as students conduct experiment.
9. Have students share results and discuss questions.

EXPECTED DATA:

Test Tube Number	pH
1	5.0 to 7.0
2	7.0
3	3.0
4	8.0
5	9.0
6	11.0
7	10.5
8	4.0
9	3.0
10	3.0
11	4.0
12	3.0
13	6.5
14	4.0
3&4	4.5

1. All solutions with pH values less than 7.
2. All solutions with pH values greater than 7.
3. Deionized water may be neutral, depending on the area. (This is the only possibility among the solutions listed.)
4. The final pH fell between the pH of the acid and the pH of the base. If the acid and base were mixed in exactly the correct proportions, the pH would be 7. Neutralization.
5. A gas was given off. Used in baking to make doughs and batters rise.
6. No, the pH of tap water varies with the location because solids and gases dissolved in water affect pH.
7. You can test the substance with pH indicator paper.

EVALUATION:

Completed in Steps 8 and 9 of procedure.

TEACHER NOTES:

Have students conduct acidity tests on various soft drinks and compare them to vinegar (pH 2.8) and the gastric juices of the stomach (pH 2). Form a pH scale plotting all the substances tested.

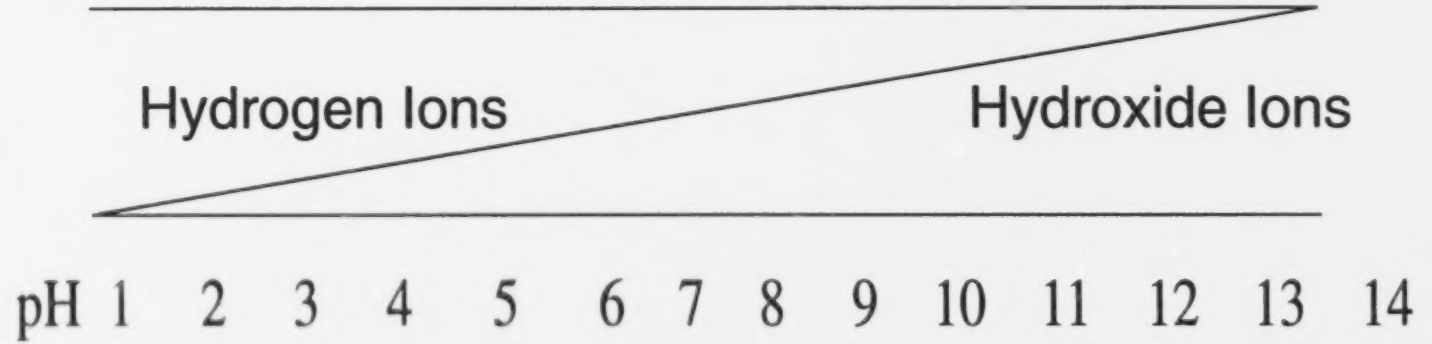
STATE GOALS:

BPS1-8-D2; BPS1-8-F3; BPS1-8-L1; BPS1-10-F2; BPS1-10-L2; BPS1-12-C1; BPS1-12-C2; BPS1-12-D3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8,10-A5; BPS3-8,10-B3; BPS3-8,10-B4; BPS3-8-B6; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-B1; BPS4-8,10-E1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-M1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA2-8,10,12-B1; LA2-8,10,12-B2; LA2-8-D1; LA2-8-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA4-8-D1; LA4-8-D2; LA4-12-E2; M3-8-D2; M3-12-A3; M3-12-E1.

Courtesy of *Food Science and You*, Glencoe Publishing Company

SA-157

HYDROGEN AND HYDROXIDE ION CONCENTRATION



SA-159

Courtesy of *Food Science and You*, Glencoe Publishing Company

THE pH OF COMMON SUBSTANCES

Experiment

A pH scale is used to identify whether a substance is an acid, a base, or neutral. Pure water, which is neutral, has a pH of 7. This is midpoint on a scale ranging from 0 to 14. A substance with a pH less than 7 has a high concentration of hydrogen ions and is considered an acid. If the pH is greater than 7, the substance has a high concentration of hydroxide ions and is considered a base. In this experiment, you will test some common substances to determine their pH values.

Materials:

- 14 test tubes
- pH indicator paper 1 to 11 range
- Deionized water
- Sodium bicarbonate (baking soda)
- Ammonia
- Buttermilk
- Cream of tartar
- Cranberry-apple juice
- Powdered orange drink
- Test tube rack
- Marking pen
- White vinegar (5% acetic acid)
- Egg white
- Milk of magnesia
- Lemon juice
- Lemon-lime soda
- Milk

Procedure:

1. Prepare half a test tube of each of the 14 substances listed in the data table. Shake all mixtures to be sure they are dissolved. Label each test tube with the name of the substance it contains.
2. Using pH indicator paper, determine the pH of each solution by dipping the paper into each liquid sample and matching the color to the chart provided. Record your results in your data table.
3. After the pH of all 14 solutions has been tested, combine the contents of test tubes 3 and 4. Be sure to mix thoroughly. Record the pH of the resulting solution.

Questions:

1. Which solutions were acidic?
2. Which solutions were basic?
3. Which solutions were neutral?
4. When an acid and a base were mixed together in Step 3, what happened to the pH? What is this process called?
5. What did you observe when you mixed the solutions in Step 3? How is this chemical reaction used in preparing some foods?
6. Do you think all tap water has the same pH? Why or why not?

Conclusion:

7. How can you tell if a substance is an acid or a base?

Test Tube Number	Solution	pH
1	tap water	
2	deionized water	
3	vinegar (5% acetic acid)	
4	sodium bicarbonate (a few crystals) dissolved in deionized water	
5	egg white	
6	ammonia	
7	milk of magnesia	
8	buttermilk	
9	lemon juice	
10	cream of tartar (a few grains) dissolved in tap water	
11	lemon-lime soda	
12	cranberry-apple juice	
13	milk	
14	powdered orange drink dissolved in tap water	
3-4	mixture of test tubes 3 and 4	

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EFFECTS OF ACIDS AND BASES ON THE COLOR OF VEGETABLES

OBJECTIVES:

Determine the effects of acids and bases when cooking vegetables.
Demonstrate responsibility for carrying out activity.
Read and follow directions.

MATERIALS:

One copy of **Effects of Acids and Bases on Vegetables** experiment worksheet per student
Per Lab Group
Food samples
Variation 1: three carrots
Variation 2: one small head red cabbage
Variation 3: one small head cauliflower
Variation 4: one bunch broccoli or 1 1/2 cup green beans

Three small or medium saucepans with lids	Water
Three large beakers	Marking pen
50 mL (1/4 c.) vinegar or lemon juice	Fork
15 mL (1 Tbsp.) baking soda	Masking tape
Tongs or slotted spoon	Three small plates

PREPARATION:

Stock supply table with vegetable samples and vinegar or lemon juice and baking soda.
Frozen vegetables may be substituted if necessary, but cooking time will be shorter.

PROCEDURE:

1. Introduce activity by displaying the vegetables. Ask students if they know how vegetables get their color? Have you ever seen a *yellow* cabbage? Explain that a vegetable is green, red, yellow, or white depending upon specific natural pigments which give plants color. When a vegetable is cooked, the color, aroma, texture, and flavor change due to acids or bases present in the water supply or added to the cooking water.
2. Divide class into lab groups of two students each.
3. Distribute **Effects of Acids and Bases on Vegetables** experiment worksheet and review directions. Assign food sample variation per lab group.
4. Prepare master chart on chalkboard for students to record results.
5. Discuss results and answer questions.

EXPECTED DATA:

Sample Data Table:
A - Water (control)
All vegetables remained the same color, unless overcooked.
B - Acid
1. Broccoli: Olive green; tough texture; little change in aroma.
2. Red cabbage: Red-violet; tough texture; some change in aroma.
3. Cauliflower: Light cream color; tough texture; little change in aroma.
4. Carrots: No color change; tough texture; no change in aroma.

C - Base

1. Broccoli: Bright green; mushy-soft; little change in aroma.
2. Red cabbage: Violet-blue; very mushy; little change in aroma.
3. Cauliflower: Yellowish; mushy-soft; little change in aroma.
4. Carrots: Darker orange color; softer texture; little change in aroma.

Questions:

1. Yes, if they contain the same color pigment, because the pigments react the same in acids and bases.
2. Answers will vary.
3. Hard water is basic; would get better results if acid was added to vegetables while cooking. (If hardness is due to calcium or magnesium salts, vegetables will have a firm texture.)

Conclusion:

4. Acids intensify color and toughen texture. Bases brighten green color, turn red color blue, and turn white color a more intense creamy yellow. Bases cause a mushy texture, which causes loss of nutrients from vegetable cells.

EVALUATION:

Completed in Step 5 of procedure.

TEACHER NOTES:

To demonstrate the reversibility of the color change in pigments, have students treat the cooking liquids in the beakers before disposing. Add a base to B-Acid and an acid to C-Base and observe any changes in color. The color change for red cabbage and white cauliflower is reversible, while the color change for green broccoli is irreversible.

STATE GOALS:

BPS1-8-B1; BPS1-8-F3; BPS1-8-F5; BPS1-10-L2; BPS1-12-C1; BPS1-12-C2; BPS1-12-D3; BPS1-12-F2; BPS1-12-E3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8,10-B3; BPS3-8-B4; BPS3-8-B5; BPS3-8-B6; BPS3-12-A.B; BPS4-8,10-B1; BPS4-8,10-E1; BPS4-8,10-F1; BPS4-8-M1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-G1; LA2-8-B1; LA2-8,10-B2; LA2-10-B3; LA2-8-D1; LA2-8-D2; LA2-8,10,12-F1; LA2-8,10-F3; LA2-8,10-F4; LA2-8,10,12-A1; LA2-8,10,12-A2; LA2-8,10,12-B1; LA4-8-D1; LA4-8-D2; LA4-12-E2; M3-8-D2; M3-12-A3; M3-12-E1.

Courtesy of *Food for Today*, Glencoe Publishing Company

EFFECTS OF ACIDS AND BASES ON VEGETABLES

Experiment

When vegetables are cooked in water containing acids or bases, their color, as well as aroma, texture, and flavor, may be affected. In this experiment, you will cook a vegetable in water, in an acid, and in a base.

Materials:

Food Sample (assigned by teacher)
- **Variation 1:** 3 carrots
- **Variation 2:** 1 small head red cabbage
- **Variation 3:** 1 small head cauliflower
- **Variation 4:** 1 bunch broccoli or 375 mL (1 1/2 cup) green beans

Tongs or slotted spoon
3 small plates
3 small or medium saucepans with lids
50 mL (1/4 cup) vinegar or lemon juice
15 mL (1 Tbsp.) baking soda
Water
Marking pen
Masking tape
Fork
3 large beakers

Procedure:

1. With a marking pen, mark the saucepans on the sides: **A**, **B**, and **C**.
2. Using masking tape, label the plates and beakers: **A–Water**, **B–Acid**, and **C–Base**.
3. Prepare assigned vegetable by washing and cutting into 2.5 cm (1 in) square pieces.
4. Divide vegetable pieces into three equal portions.
5. Place each portion into a separate saucepan.
6. Add vinegar or lemon juice (acid) to saucepan **B**.
7. Add baking soda (base) to saucepan **C**.
8. Add cold tap water to each pan to just cover the vegetables. Place lids on pans.
9. Cook on high heat, watching carefully. When steam begins to appear at edges of the lid, turn the heat down to medium or medium-low so that the water does not boil over.
10. Simmer vegetables until those in pan **A** are fork-tender. (10 to 20 minutes)
11. Remove all three pans from stove and place on heatproof surface.
12. Carefully lift saucepan lid **A** and remove vegetables with tongs or slotted spoon. Allow liquid to drain off and place the vegetables on plate labeled **A–Water**. Pour cooking liquid into beaker with the same label.
13. Follow same procedure for vegetables in saucepans **B** and **C**.
14. Examine the three samples and notice their color. Record observations in data table.
15. Smell the vegetables and note differences in aromas.
16. Cut the vegetables with a fork. Take a small bite. Note the differences in texture.
17. Taste a small portion of each vegetable and record the flavor.
18. Observe the color of the liquid in the beakers.
19. Dispose of samples and liquids as directed by teacher.
20. Record your data on the chalkboard. Copy the data from the other variations.

(continued)

Courtesy of *Food for Today*, Glencoe Publishing Company

EFFECT OF ACIDS AND BASES ON VEGETABLES

Experiment
(continued)

Questions:

1. Would all vegetables of the same color pigment react the same in acids and bases? Why or why not?
2. Which of the three methods produced the most acceptable vegetable? Why do you prefer it?
3. How would the results from this experiment help you if you lived in an area with hard water (high in minerals)?

Conclusion:

4. What are the effects of acids and bases on cooked vegetables?

Sample Data Table

Vegetable Cooked: _____		**Pigment Color:** _____	
Characteristics	**A - Water** (control)	**B - Acid**	**C - Base**
Color of vegetable			
Aroma			
Texture			
Flavor			
Color of liquid			

Courtesy of *Food for Today*, Glencoe Publishing Company

EXAMINING BACTERIA

OBJECTIVES:

Recognize the positive and negative aspect of bacteria activity.
Observe and identify the three basic types of bacteria.
Organize and manage human and material resources.
Read and follow directions.

MATERIALS:

Two to three slices of Swiss cheese
Bacteria Can Be Helpful transparency
One copy of **Bacteria Classification** experiment worksheet for each student
Microscope per two to four students
Prepared slides of cocci, bacilli, and spirilla bacterium

PREPARATION:

None

PROCEDURE:

1. Introduce activity by showing class several slices of Swiss cheese and asking, "How do you suppose the holes get into Swiss cheese?"
2. Allow students to respond and then tell them that Swiss cheese is an example of a food product that is made with the help of bacteria.
3. Cut cheese into small pieces and distribute to the students.
4. Ask students to chew the cheese carefully and note the taste.
5. Explain the following:
   a. Swiss cheese is made from milk.
   b. A bacterial culture is introduced into the milk.
   c. Bacteria live, reproduce, and feed on the milk.
   d. Bacteria give off carbon dioxide as a waste product.
   e. Carbon dioxide forms bubbles in the cheese causing holes.
   f. Other waste products produce the "cheesy" taste.
6. Ask students for other examples of how bacteria can be used for helpful, not harmful, purposes.
7. Display **Bacteria Can Be Helpful** transparency for a summary.
8. Explain that one way of classifying bacteria is by their shape. This lab activity allows you to observe, identify, and draw the three basic types of bacteria.
9. Divide class into lab groups of two students each.
10. Distribute **Bacteria Classification** worksheets and review directions.
11. Discuss answers to questions following observation experiment.

EXPECTED DATA:

1. Cocci, bacilli, and spirilla. Identification of the name and shape of each bacterium will vary.
2. Spirilla are clearly the largest, as they are long and thin. In general, individual cells of bacilli are larger than individual cells of cocci.
3. By shape. How they live (aerobic–with air versus anaerobic–without air), what they do, how they are stained.

EVALUATION:

Completed in Step 10 of procedure.

TEACHER NOTES:

Prepared bacterium slides may be obtained from a medical laboratory or chemical supply company. The activity may be done without individual observation by using a transparency of the three bacterium shapes from the worksheet.

STATE GOALS:

BPS1-8-P4; BPS1-12-M3; BPS2-12-D1; BPS4-8,10-A1; BPS4-8,10-B1; BPS4-8,10-I1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8,10,12-B2; LA2-8,10-C3; LA2-8,10-D1; LA2-8-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-B1; LA3-8,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8,10-C2; LA4-8-D2; LA4-8,12-E2; LA4-8-D1; LA4-10-C1; SS5-8-B2; SS5-8-J2.

Courtesy of *Life Science*, Addison-Wesley Publishing Company

BACTERIA CAN BE HELPFUL

- Produce foods

yogurt	cheeses	buttermilk
butter	sour cream	pickles
olives	sauerkraut	vinegar

- Protect against illness

antibiotics	vitamins	insulin

- Decompose waste
- Breakdown cellulose to make linen and rope
- Prepare skins for making leathers
- Change nitrogen in air to nitrates useable by plants
- Clean up toxic waste areas
- Use in genetic research
- Control pest organisms

SA-167

BACTERIA CLASSIFICATION

Experiment

Bacteria are classified by their shapes. Round ones are cocci (KOK-sigh). The rod-shaped ones are bacilli (bah-SIL-eye). The spiral-shaped ones are known as spirilla (spy-RIL-uh). Some bacterial species form clusters of two or more cells. Others occur in chains hooked together or clustered like a bunch of grapes.

Materials:

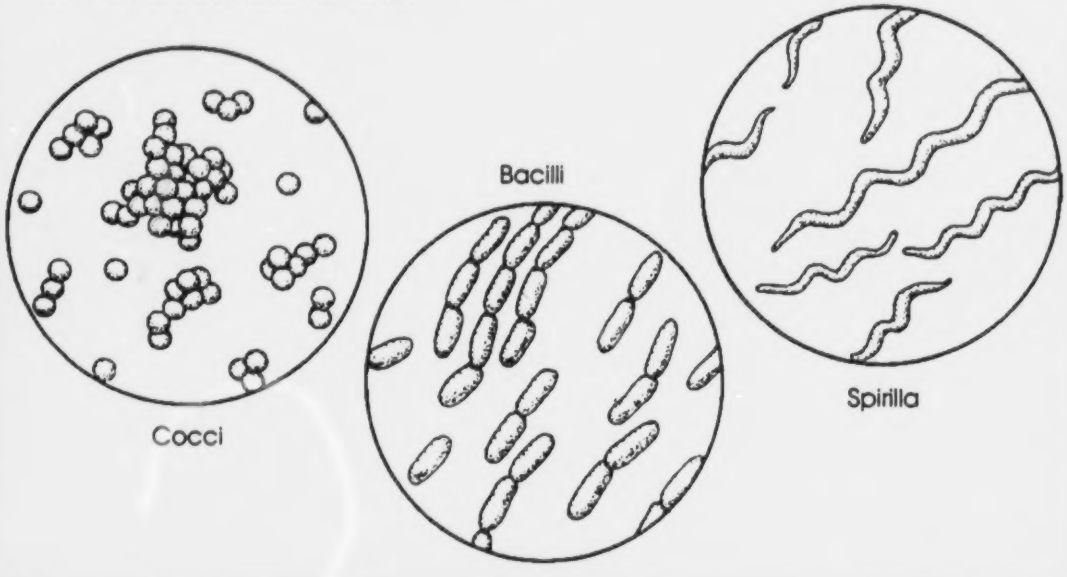
Prepared slides of cocci, bacilli, and spirilla bacterium
Microscope

Procedure:

1. Draw three large squares (about 5 cm square) on a piece of paper.
2. Obtain a prepared slide of each type of bacterium.
3. Set up microscope and observe one slide under low power.
4. Carefully switch the objective to high power.
   CAUTION: Use only the fine focus in high power.
5. Notice the size and shape of the bacteria you are observing. (Your bacteria may be stained with a dye to make them visible. In nature, bacteria are not colored.)
6. In one of the squares, draw a few of the bacteria you see under the microscope. Try to make your drawing as accurate as possible.
7. Label your drawing with the name of the species of bacterium you are observing.
8. Repeat procedure for the other two slides.

Questions:

1. What three types of bacteria did you observe? Give the name and shape of the bacterium for each.
2. How do the sizes of the three types of bacteria compare?
3. How are bacteria classified?



Courtesy of *Life Science*, Addison-Wesley Publishing Company

RECOGNIZING MULTIPLE OPPORTUNITIES FOR FOOD CONTAMINATION

OBJECTIVES:

Determine where bacteria are found.
Demonstrate responsibility for carrying out activity.
Relate to and communicate with others.

MATERIALS:

One copy of **Growing Cultures** experiment worksheet for each student
One petri dish filled with nutrient agar per two students
Felt-tip pens
Cellophane tape
Masking tape

PREPARATION:

1. Obtain agar-filled petri dishes from chemical supply company or prepare your own.
2. Prepare by adding 15g agar to 1000mL water and heating to a boil to dissolve agar completely. Pour boiling mixture into sterile petri dishes. The dishes should hold 50 to 60 mL each.

PROCEDURE:

1. Introduce activity by explaining that bacteria can be found everywhere. Single microorganisms are not visible, but colonies of microorganisms, called cultures, can be seen. This experiment will illustrate just how widespread microorganisms really are.
2. Divide class into lab groups of two students each.
3. Distribute worksheet and review directions.
   a. Demonstrate how to collect and transfer a sample using cellophane tape. (Directions on worksheet.)
   b. Assign either samples A, B, C, or D to each lab group.
4. After students have completed sampling, collect petri dishes and incubate upside down in a warm place.
5. Allow students to observe petri dishes and record data daily for the next three days.
6. Encourage students to add their data to the master data table on the chalkboard.
7. Discuss results and conclusions with students.
8. Have students turn in dishes for disposal.

EXPECTED DATA:

Data will vary greatly, but, in general, any unwashed surface is likely to produce one or more types of bacteria. As long as the tape is a reasonably new roll, the section of agar touched only by clean tape should remain free of bacterial growth. Food contamination can be minimized by washing surfaces and utensils that come in contact with food, washing hands before handling food, and rewashing hands after touching hair or clothing while working with food.

EVALUATION:

Completed in Steps 5 through 7 of procedure.

TEACHER NOTES:

Other sample sources may be included so that students see a variety of opportunities for food contamination. Include items such as money, open soda can, dirty towel, lunch bag, used straw, and animal hair.

STATE GOALS:

BPS1-8-B1; BPS1-8-L2; BPS1-8-M1; BPS1-12-D3; BPS1-12-E1; BPS3-8-A1; BPS3-8-A2; BPS3-8-A5; BPS3-8,10-B3; BPS3-8-B5; BPS3-12-A.B; BPS4-8,10-A1; BPS4-8,10-D1; BPS4-8-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-D2; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8,10,12-B2; LA2-8,10-C3; LA2-8,10-D1; LA2-8,10-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-B1; LA3-8,12-C1; LA3-8,10,12-E1; LA4-8-A1; LA4-8,10-C2; LA4-8-D1; LA4-8-D2; LA4-8,12-E2; LA4-8-A1; LA4-8,10-C2; LA4-10-C1; PDH2-8-K3; PDH2-8-K4; PDH2-8-T1; PDH2-8-T3; PDH2-10-T2; PDH6-10-J1; PDH6-12-I2; PDH6-12-J3; SS5-8-B2; SS5-8,12-C1; SS5-8-I2; SS5-8-J2; SS5-10-J1; SS5-10-J3; SS5-12-I2.

GROWING CULTURES

Experiment

You can't see single microorganisms, but when they grow and multiply into colonies, or cultures, they become visible. This experiment gives you a chance to discover just how widespread microorganisms really are.

Materials:

Petri dish of nutrient agar
Cellophane tape
Felt-tip pen
Masking tape

Procedure:

1. Obtain a petri dish.
2. Use a felt-tip pen to draw two intersecting lines on the bottom of the dish to divide it into quarters. Number the quarters 1 to 4.
3. Circle the sample for testing as assigned to you by your teacher.

Samples A	Samples B	Samples C	Samples D
your forehead	your hair	drinking fountain	tabletop
sink bottom	clean dish	unwashed fingertip	floor
cutting board	water faucet	washed fingertip	doorknob

4. Using cellophane tape, touch sample, pull from the surface, and immediately place on one of the quarter sections of the petri dish. Remove and discard tape.
5. Record sample source and dish location number on your data table.
6. Repeat procedure with other two test samples. Record identification information.
7. As a contol, use another piece of tape and touch remaining quarter section of dish. Be careful not to touch anything else with the tape. Record information.
8. Take an 8-inch piece of masking tape, write your name and class period, and wrap around edges of petri dish to seal.
9. Incubate petri dish at room temperature for three days in the place designated by your teacher.
10. Observe petri dish daily. Describe in your data table and on the chalkboard any growths that have appeared on the agar.
11. In your data table, copy the information on the growths reported by the other groups.

Questions:

1. Was the tape itself free of microorganisms?
2. Were any of the surfaces tested free of microorganisms? Which ones?
3. Which surface produced the most bacterial growth? Why do you think this occurred?
4. How can you minimize the likelihood of food contamination?

Sample Data Table

Surface Tested	Dish Area #	Agar (Day 1)	Agar (Day 2)	Agar (Day 3)

Courtesy of *Focus on Life Science*, Merrill Publishing Company SA-171

TRANSFERING SANITATION KNOWLEDGE TO THE INDIVIDUAL AND THE WORKPLACE

OBJECTIVES:

Determine how chemicals prevent the growth of microbes.
Demonstrate responsibility for carrying out activity.
Read and follow directions.

MATERIALS:

One copy of **Preventing Microbe Growth** experiment worksheet per student
Per Lab Group:

- Four petri dishes of nutrient agar
- Four small beakers
- 100 mL graduated cylinder
- 50 mL disinfectant
- 50 mL alcohol
- 50 mL hydrogen peroxide
- 50 mL mouthwash
- Four 2 cm squares of filter paper
- Forceps
- Felt-tip pen
- Masking tape

PREPARATION:

1. Purchase prefilled agar petri dishes or prepare your own.
2. Cut filter paper into 2 cm squares.
3. Set up supply table with solutions and filter paper squares.

PROCEDURE:

1. Introduce the activity by asking students to identify the places or facilities where microorganisms can grow and produce diseases? Include the information from content outline (II I 6 a 1)-8)). This experiment will help you determine how to prevent growth of microbes.
2. Divide class into lab groups of two students each.
3. Distribute experiment worksheets and review directions.
4. Demonstrate how to use forceps correctly.
5. Circulate throughout the lab while students conduct experiment.
6. Store petri dishes in a warm place such as the top of the refrigerator.
7. Review how to form a hypothesis and work together as a group to form a hypothesis for each dish.
8. Examine petri dishes after two days.
9. Discuss results and draw conclusions.

EXPECTED DATA:

No growth beneath squares D, A, and H of Dish 1. Some growth under square M. Several colonies around the squares of Dish 1. Hundreds of colonies in Dish 2. Many colonies in Dishes 3 and 4.

1,2. Answers will vary depending on the kinds of solutions used.
3. Controls
4. Dish 2
5,6. Limit the growth of microbes.
7. Answers will vary.
8. Antiseptics, disinfectants, and sunlight.

EVALUATION:

Completed in Steps 8 and 9 of procedure.

TEACHER NOTES:

Different mouthwashes, antiseptics, and disinfectants may be used. Students may wish to compare the relative effectiveness of these. Students could survey the cleaning supplies in their household and make a list of the ones that kill microbes. Dispose of dishes by spraying cultures with a strong household disinfectant. Seal dishes with tape before discarding.

STATE GOALS:

BPS1-8-B1; BPS1-8-E2; BPS1-8-M4; BPS1-10-D4; BPS1-10-I1; BPS1-10-M1; BPS1-12-E1; BPS1-12-M3; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8-A5; BPS3-8-B1; BPS3-8,10-B3; BPS3-8-B4; BPS3-8-B6; BPS3-12-A.B; BPS4-8,10-B1; BPS4-8,10-A1; BPS4-8,10-C1; BPS4-8,10-D1; BPS4-8,10-F1; BPS4-8,10-G1; BPS4-8,10-H1; BPS4-8,10-I1; BPS4-8-J1; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B3; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8,10,12-B2; LA2-10,12-B1; LA2-8-D1; LA2-8-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA3-8,10,12-E1; LA4-8-A1; LA4-8,10-C2; LA4-8-D1; LA4-8-D2; LA6-8-A1; LA6-8,10-C2; LA6-10-C1; PDH2-8-T1; PDH2-8,10-T2; PDH2-8,10-T3; PDH6-10-J1; PDH6-12-J3.

Courtesy of *Focus on Life Science*, Merrill Publishing Company

PREVENTING MICROBE GROWTH

Experiment

Disease-producing microorganisms must be controlled for the safety of people. Food preparation areas, PE locker rooms, and bathroom and restroom facilities are a few of the places which can harbor microbes. This experiment will help you determine how chemicals prevent microbe growth.

Materials:

- 4 petri dishes of nutrient agar
- 4 small beakers
- Four 2 cm squares of filter paper
- 100 mL graduated cylinder
- Forceps
- Masking tape
- Felt-tip pen
- Solutions:
  - Alcohol
  - Mouthwash
  - Disinfectant
  - Hydrogen peroxide

Procedure:

1. Label four petri dishes with your name and the numbers 1 through 4.
2. Remove the covers and rub a finger over the surface in each dish. Replace covers.
3. For each of the four solutions, pour 50 mL into a small beaker. Label solutions.
4. Obtain four squares of filter paper. Label squares D, A, H, and M.
5. Soak D in the beaker with disinfectant; A in alcohol; H in hydrogen peroxide; and M in mouthwash.
6. With forceps, place the four squares separately on the nutrient agar in petri dish 1. Cover the dish.
7. Place petri dishes 1 and 2 in a warm dark place for two days.
8. Place petri dishes 3 and 4 in a sunny place. Remove the cover from petri dish 3. Leave both dishes for 20 minutes.
9. Replace the cover on petri dish 3 and store both dishes, 3 and 4, in a warm, dark place for two days.
10. Record a hypothesis for what will occur in each of the four dishes.
11. After two days, examine each dish.
12. In dish 1, compare bacterial growth under each square with growth where there were no squares.
13. Compare growth in all petri dishes.
14. Record observations in data table.
15. Give agar dishes to your teacher for proper disposal.

Questions:

1. Under which square was the most growth?
2. Under which square was the least growth?
3. What is the purpose of dishes 2 and 4?
4. Which dish had the most growth?
5. What effects do antiseptics and disinfectants have on the growth of microbes?
6. What effect does sunlight have on the growth of microbes?
7. Did you accept or reject the hypothesis you made for each dish? Explain.
8. What will prevent the growth of microbes?

(continued)

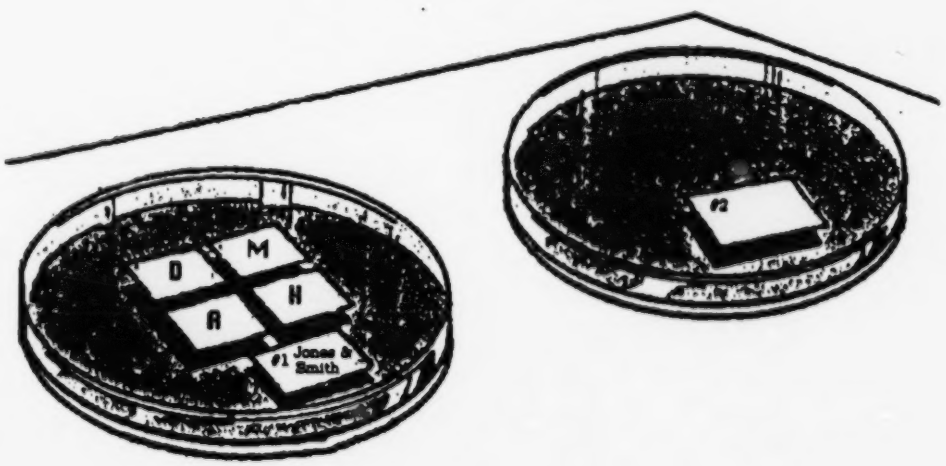
Courtesy of *Focus on Life Science*, Merrill Publishing Company

PREVENTING MICROBE GROWTH

Experiment (continued)

Sample Data Table

Dish	Square	Observations
1	D	
	A	
	H	
	M	
2	None	
3	None	
4	None	



Courtesy of *Focus on Life Science*, Merrill Publishing Company

RECOGNIZING AND ELIMINATING COMMON SAFETY HAZARDS AT HOME AND WORK

OBJECTIVES:

Identify common hazards in the kitchen.
Determine how to correct hazardous situations in the kitchen.
Read and follow directions.
Relate to and communicate with others.

MATERIALS:

One copy of **How Would You Make this Kitchen Safe?** handout for each student
One copy of **I Should Always .... I Should Never ....** worksheet for each student

PREPARATION:

None

PROCEDURE:

1. Introduce activity by asking students why more accidents happen in the kitchen than in any other room of the house? Explain a major cause of accidents is distraction–not keeping your mind on your work. Much kitchen work is routine such as washing dishes or stirring hot food, and often you may want to talk to someone on the phone or someone working with you. Yet, even a slight lapse of attention can result in a burn or a cut. This activity allows you to be a detective and locate potential safety hazards in the kitchen.
2. Distribute **How Would You Make this Kitchen Safe?** handout for students to complete.
3. Summarize by writing safety hazards on chalkboard from student responses.
4. Distribute **I Should Always .... I Should Never ....** worksheet for students to complete.
5. Discuss and provide correct answers.

EXPECTED DATA:

Picture

1. Too many appliances on one outlet.
2. Hot pad hanging over burner.
3. Bottle of cooking oil spilled on floor.
4. Pan containing hot food has handle sticking out.
5. Mixer cord across range.
6. Hot pad on burner.
7. Person standing on chair.
8. Electrical appliances placed close to sink.
9. Sharp knife left in sink.
10. Cord to iron extended across sink.
11. Cord to iron dangling over edge of counter.
12. Cabinet door left open.
13. Food stored in cabinet under sink.
14. Cleansers and other hazardous substances stored on low shelf.
15. Cleansers and other hazardous substances stored with food.
16. Throw rug could cause falls.
17. Broken glass on floor.
18. Cat eating in kitchen.

Worksheet

Safe

1. 9.
4. 11.
5. 13.
7. 14.
8. 18.

Unsafe

2. 15.
3. 16.
6. 17.
10. 19.
12. 20.

EVALUATION:

Completed in Steps 3 and 5 of procedure.

TEACHER NOTES:

Other activities might include preparing a video of proper safety procedures for preventing falls and cuts in the kitchen or compiling, printing, and distributing a booklet or brochure to parents of young children on how to childproof a kitchen (or home).

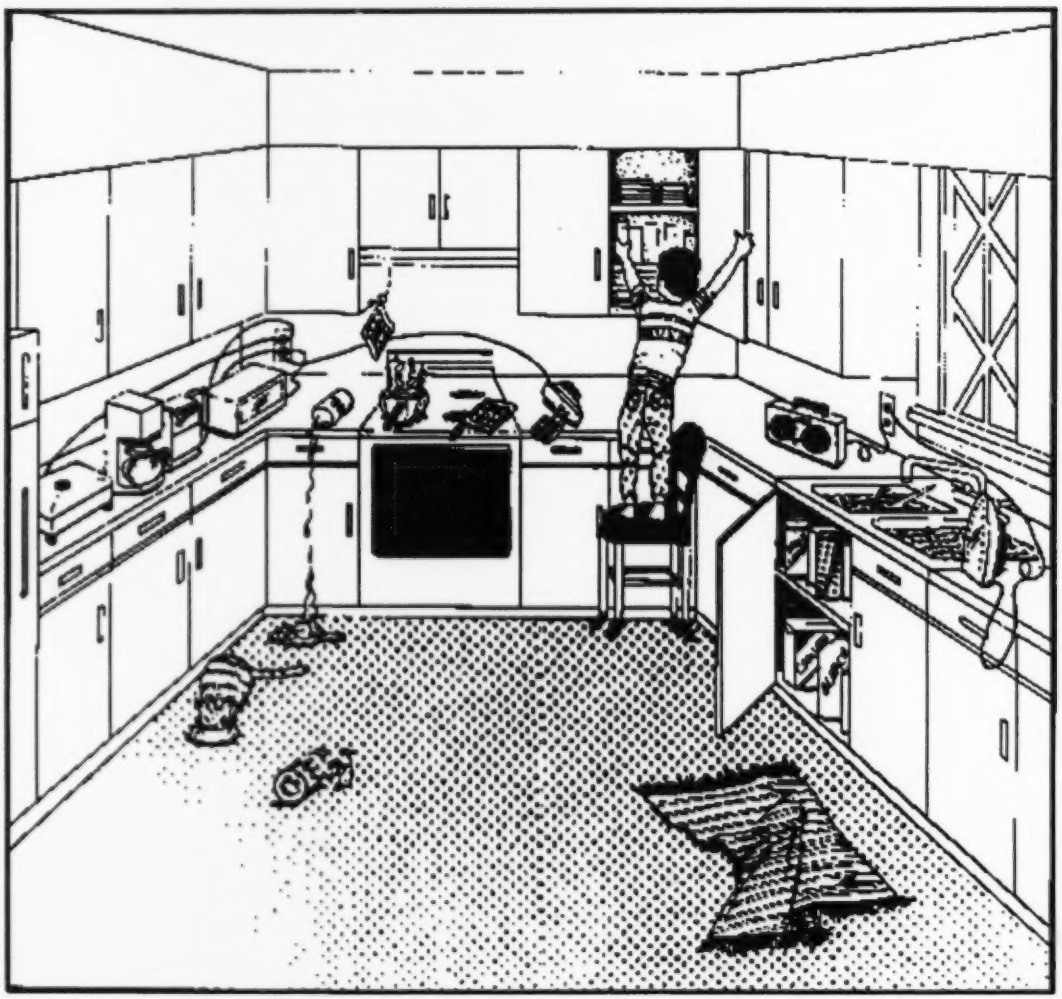
STATE GOALS:

LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-A3; LA1-8,10,12-B1; LA1-8,10,12-B2; LA1-8,10,12-C1; LA1-8,10,12-D1; LA1-8-D2; LA1-8,10,12-E1; LA1-8,10,12-E2; LA1-8,10,12-G1; LA2-8,10,12-B1; LA2-8,10,12-B23; LA2-8-D1; LA2-8-D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA4-8-A1; LA4-8-D1; LA4-8-D2; LA4-12-E2; PDH2-8-K3; PDH2-8-K4; PDH2-10-K4; PDH2-10-K6; PDH2-12-Q1; PDH3-8,10,12-A1; PDH3-8,10,12-A1; PDH3-8,10,12-A2; PDH3-8-G1; PDH3-8-G2; PDH3-12-G1.

Courtesy of *Food for Today*, Glencoe Publishing Company

HOW WOULD YOU MAKE THIS KITCHEN SAFE?

The kitchen is the most hazardous room in the house. There are 18 safety and sanitation hazards in the kitchen pictured here. How many can you identify? What would you do to correct each hazardous situation?



Courtesy of *Food for Today*, Glencoe Publishing Company

SA-179

I SHOULD ALWAYS . . . . I SHOULD NEVER . . . .

Worksheet

Directions: Write **safe** on the line before each statement which is a safe or healthy practice in the kitchen. Write **unsafe** on the line for unsafe or unhealthy practices and explain why in the space below the statement.

_____ 1. Throw baking soda on a grease fire.

_____

_____

_____ 2. Eject beaters from electric mixer while still in motion.

_____

_____

_____ 3. Place stirring spoons on counter or range top.

_____

_____

_____ 4. Store matches in glass containers.

_____

_____

_____ 5. Pour hot liquids away from self.

_____

_____

_____ 6. Use cloth towels to wipe up spills.

_____

_____

_____ 7. Use cold water and ice on minor burns.

_____

_____

_____ 8. Use cutting board for chopping vegetables.

_____

_____

_____ 9. Separate cutting tools from flatware for cleanup.

_____

_____

_____ 10. Use extension cord for appliance with short cord.

_____

_____

SA-181

I SHOULD ALWAYS . . . . I SHOULD NEVER . . . .

Worksheet (continued)

_____ 11. Use rubber spatula after stopping blender/mixer.

_____ 12. Touch burner or appliance with back of hand to test for heat.

_____ 13. Close drawers and doors tightly.

_____ 14. Tie back long hair.

_____ 15. Clean up broken glass with vacuum cleaner.

_____ 16. Store chemicals and cleaners under the sink.

_____ 17. Carry flaming grease to sink.

_____ 18. Use cutting board or protective mat under small heating appliances.

_____ 19. Leave leftovers on counter until cool—at least two hours.

_____ 20. Store unwashed baking sheets or iron skillets in the oven for next use.

Courtesy of *Nutrition and Foods*, Indiana Curriculum Guide.

FOODS AND SENSORY EVALUATING

OBJECTIVES:

Distinguish the training and skills necessary for a career in sensory evaluation.
Design an original taste-testing experiment.
Demonstrate responsibility for carrying out activity.

MATERIALS:

One copy of **A Taste of Taste Testing** experiment worksheet for each student

PREPARATION:

None

PROCEDURE:

1. Introduce activity by explaining there are many career options available in the areas of food science and technology. If you like tasting food, you might enjoy a career in sensory evaluation. This involves testing food using the human senses. It requires a college degree in food science. This activity allows you to design an original taste-testing experiment similar to one by a sensory evaluator.
2. Divide class into lab groups of two students each.
3. Distribute **A Taste of Taste Testing** experiment worksheet and review instructions.
4. Review students' proposed experiments before giving approval.
5. Allow students to conduct experiments.

EXPECTED DATA:

Varies according to student's experiment.

EVALUATION:

Obtain information from the closest college or university that offers a major in food science. Have students investigate the entrance requirements and what would be included in a course of study in food science.

TEACHER NOTES:

Students could interview people who work in careers related to food. Determine the training and skills needed for the various positions.

STATE GOALS:

BPS1-8-3; BPS2-8-D2; BPS3-8,10-A1; BPS3-8,10-A2; BPS3-8,10-A5; BPS3-8,10-B3; BPS3-8,10-B4; BPS3-8-B6; BPS3-12-A.B, BPS4-8-G1; BPS4-8,10-J1; BPS4-12-A.M; LA1-8,10,12-A1; LA1-8,10,12-A2; LA1-8,10,12-C1; LA1-8,10,12-D1; LA2-8,10,12-B1; LA2-8,10,12-B2; LA2-8-D1; LA2-8,D2; LA2-8,10,12-F1; LA2-8,10-F2; LA2-8,10-F3; LA2-8,10-F4; LA3-8,10,12-A1; LA3-8,10,12-A2; LA3-8,10,12-B1; LA4-8-D1; LA4-8-D2; LA4-12-E2.

A TASTE OF TASTE TESTING

Experiment

This experiment is to be an intermediate step between following instructions and designing a completely original experiment. Therefore, the instructions for this experiment will be general, rather than detailed. It will be up to you to design the exact procedure you will follow.

Many people who drink cola products say they have a preference for one product. But how many people can actually distinguish their choice from the other colas? Given a choice between their product and another cola, how many will actually select their cola as the one they like best? In this experiment, you will use your knowledge of sensory testing to design and carry out a taste-testing experiment involving colas.

There are various ways taste-testing experiments can be done. In one format, tasters are given three randomly labeled samples and asked to select the one that is different from the other two. Another format involves giving tasters two samples and asking them to select the one they prefer. If the sense of sight can be eliminated, tasters can be given a cola product and a lemon-lime product and asked to select the "cola" they prefer.

In designing this experiment, remember what you learned earlier about nonpreferential labeling of samples. Eliminate as many variables as possible to make your results meaningful.

After you have written your procedure, designed your data table, and prepared your questions, submit your proposed experiment to your teacher for approval. Once you have that approval, you can proceed with your cola taste-test.

Courtesy of *Food Science and You*, Glencoe Publishing Company SA-185

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